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ABSTRACT

This curriculum outline provides secondary and postsecondary instructors with detailed information on student learning outcomes for completion of the general mechanics program requirements. A program overview discusses the aims of education; secondary school philosophy; and career preparation programs and their goals, organization, and evaluation. Sections two and three provide the curriculum format for programs in grades 11 and 12, respectively. Each program is divided into units containing from one to nine modules. Both course and unit general aims are cited. Modules consist of these components: goal statements, learning outcomes, and student activities to support the learning outcomes. Topics covered in the 23 units in the grade 11 program and the 13 units in the grade 12 program include cooperative career preparation; school practices, human relations, and safety procedures; tools and equipment; fasteners; technical reading, writing, and reporting; mechanical drawing; gas welding; electricity; wheels, hubs, and tires; hydraulic systems; brake systems; engines; fuel systems; cooling systems; lubrication systems; clutches; transmission; driveshafts and drivelines; steering systems, suspension, and frame designs; soldering; electrical systems; power brake systems; emission control systems; and differentials. Section four lists resource materials. (YLB)

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CAREER PREPARATION PROGRAM

CURRICULUM GUIDE FOR :

GENERAL MECHANICS

PROVINCE OF BRITISH COLUMBIA

MINISTRY OF EDUCATION

DIVISION OF EDUCATIONAL PROGRAMS - SCHOOLS

CURRICULUM DEVELOPMENT BRANCH

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INTRODUCTION

The purpose of this career preparation curriculum outline is to provide the secondary school teachers and post-secondary instructors with detailed information on student learning outcomes for completion of the career preparation program requirements. Information contained in this outline may be used as reference by students, counsellors, school administrators, employers and the general public. Performance standards and guidelines for instruction will be established according to the criteria developed by teachers for the modules and courses which comprise each career preparation program.

Section One
Program Overview

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PART 1.0 AIMS OF EDUCATION

The basic function of the British Columbia system of public education is to serve society and to meet the needs of individual students. School personnel have the primary responsibility to educate everyone by enabling each student to pursue excellence, to experience success and to realize maximum potential in every course. The curriculum should enable each student to achieve educational and vocational goals in the development of their interests, skills and abilities.

Central to that responsibility is the promotion of learning, the acquisition of knowledge and the mastery of skills. This is essential to provide the student with a solid base upon which a successful future may be built. This responsibility implies an obligation to go beyond the provision of a learning opportunity and to link instruction and learning through activities that make it possible for the pupil to become a purposeful, effective and competent learner. Students should be encouraged to develop a sustained interest in learning and a confidence in their ability to learn by the realization that any study becomes effective through an orderly and sustained approach.

The primary responsibility of school personnel should be complemented by the many other facets of school life which contribute to the development of the maturing student. Teachers should encourage sportsmanship, good health and fitness, promote a willingness to serve the school and community, and provide opportunities to appreciate and share in the social customs of the school and society. Students should be encouraged to be active participants in the community by meeting their obligations and responsibilities as citizens.

The philosophy of the school is best achieved in a purposeful and challenging environment which motivates the best performance of students and staff. The environment should be safe, supportive, rewarding and satisfying; and should reflect mutual respect and courtesy among students, staff and parents. The facilities, equipment materials and organization should enable students and staff to pursue stated educational goals. The environment must also be conducive to effective participation by the staff in decisions affecting them and their students. Such participation is fostered by open, flexible and cooperative patterns of organization and communication based on a spirit of mutuality.

Teachers, parents and the community share the responsibility for fostering the optimum growth and development of each student. Shared responsibility should be directed to the end that each student will become a knowledgeable, self-reliant, self-disciplined, adaptive human being with a sense of enduring values and social and civic responsibility, able to communicate and participate effectively in a technologically advancing and increasingly mobile, complex and changing society.

PART 2.0 SECONDARY SCHOOL PHILOSOPHY

Secondary schools are primarily concerned with the development of the individual in a changing society. Organization of the secondary school system is based on the belief that students should be provided with a meaningful sequence of courses directed toward a particular purpose which they themselves consider valuable and which lies within their abilities. Motivation of adolescents to maintain a positive attitude with commitment to their studies is a challenging task for teachers. Students need educational experiences that will help them to cope with their responsibilities in society; to prepare for further education at a college, Provincial institute or university; and/or to enter employment with a marketable skill.

General goals of the secondary school system should be incorporated into the educational philosophy of each school. Secondary school curriculum goals should:

a. provide opportunities for all students to achieve a maximum of general and basic preparatory education,

b. emphasize those subjects needed for individual intellectual development for future career goals,

c. enable students to arrange subjects into broad patterns or programs on the basis of their interrelationships and usefulness for further education and employment,

d. permit individual choice of school programs according to alternatives that are available,

e. include opportunities for students to develop personal interests and avocational values,

f. increase opportunities to relate course offerings to the needs of the school population and the community, and

g. allow students to select for themselves educational goals and patterns of study in accord with their proven interests and abilities.

As students acquire and develop their skills and talents at the secondary school educational level, interest in future careers becomes increasingly important. The need to improve the transition between schools, colleges, Provincial institutes and employment has been addressed through the introduction of career preparation programs.

PART 3.0 CAREER PREPARATION PROGRAMS

3.1 Aims and Purpose

Career preparation is vitally important to every individual in their choice of lifestyle and their economic security. In conjunction with the provision of basic education for all citizens, the school system should ensure that all students are provided the opportunity to increase their awareness of career planning leading to vocational choices. The general education acquired through the public school system should complement the personal and intellectual development of individuals for success in the world of work.

Occupational needs are never static and students should have the opportunity to increase their awareness of the world of work while attending public schools. The influence of modern technology has altered individual and family lifestyles and many students recognize the need for preparatory training that will lead toward success in a vocation of their choice. This increased emphasis on education and training will help students to understand the increasingly complex world of business and industry. Pertinent questions should be considered. What are the qualifications for particular occupations? Which occupations require a post-secondary education or other credentials? Which vocations require work related experiences? How should the school experience provide for student needs as they consider their future careers?

The last question is being partially answered through Career Preparation Programs. Students who enroll in a career preparation program will gain a broad overview of a particular industry and will be provided with vocational experiences in a career area of their choice. Essential components of the total program include specialized courses with cooperative career preparation studies and the completion of all requirements leading to a secondary school graduation certificate. Examples of some career areas are the hospitality/tourism industry, general mechanics and business education. Graduates of a career preparation program may be qualified to pursue further studies toward a profession, attend a college or Provincial institute to acquire further specialized education, or proceed directly to employment with some marketable skills. Secondary school teachers will need to cooperate with employers and post-secondary instructors to effectively integrate the career preparation programs.

Adults at the school and community level have a responsibility to ensure that all students will achieve a basic understanding and awareness of the world of work to prepare for emerging trends in society. Increased school and community cooperation through the career preparation program will provide appropriate educational and career development experiences to help students acquire marketable skills for future employment. This new program for the secondary schools is consistent with the general aims of the British Columbia school system in striving to meet the needs of all students.

The development of students who can think for themselves and learn on their own is one of the more important educational goals. In career preparation programs, practical experiences that combine methods, resources and activities provide an important teaching strategy to enhance learning and thinking abilities. Both individual and group problem solving strategies help students to utilize abstract thinking abilities through practical learning activities.

In the grade 11 and 12 school terms, students in career preparation programs have opportunities to apply basic skills and abilities gained from earlier educational experiences. Learning outcomes become more effective when students can develop abilities and talents with new applications and a wider variety of resources.

The career preparation programs in British Columbia senior secondary schools are designed to provide students with options that enable students to enter the work force, proceed to a college or Provincial institute or to pursue further academic studies leading to a professional career. Courses related to career fields at the senior secondary level are intended to improve the transition of students between school and employment and between school and post-secondary institutions. Students enrolled in a career preparation program will participate in cooperative career preparation studies to spend part of their school time in a learning situation in the community at a training station. This experience is designed to provide practical experience for a student in an occupational field directly related to a program specialty in the school.

All students will utimately enter the work force in some capacity and career preparation programs will assist students to recognize current occupational practices and the avenues for advancement toward career goals. From these experiences, students can be encouraged to recognize the spectrum of employment within an occupational cluster.

3.2 Core Curriculum

Many of the core curriculum learning outcomes are integral parts of the learning outcomes that comprise a career preparation program. Students will be encouraged to relate their basic education experiences to practical experiences through the application of talents, skills, abilities and competencies to simulated roles relative to future employment responsibilities.

Career preparation programs provide opportunities for students to apply the following aspects of the core curriculum to their school experiences: (a) reading; (b) writing; (c) speaking; (d) principles of measurement; (e) roles, responsibilities and rights of the individual in society; (f) research and study skills; and (g) inquiry, analysis and problem solving. Practical application of the skills and purposes of the core curriculum to the career preparation program will help students to function effectively as active and responsible citizens.

3.3 Responsibility of the School Staff

Preparation for employment concerns everyone and the educational experiences of a student have a direct impact on each person's selection of a career path. One's choice of an occupation is closely aligned with the desires for a particular lifestyle. Teachers in our schools have a major responsibility to assist students in the development of attitudes toward work and the rewards that one may expect from future employment. School experiences should help people to prepare for satisfying and successful employment. From this premise, there is increasing recognition of the need for students to relate their school experiences to career goals and the benefits that can be derived from the completion of courses for career advancement.

The school experience for students should include the acquisition of career information, the development of skills and talents for specific occupations and the opportunity to gain practical experience along with completion of general education requirements. The purpose of career preparation is to provide students with information and generalized skills which apply to a broad series of interrelated occupations. Students will then be able to make meaningful decisions concerning the advantages and disadvantages of occupations. Along with the general education requirements a student on a career preparation program will complete the following studies in grades 11 and 12.

Grade 11: General orientation to an occupational cluster will be provided in school by practical experience in a career field and cooperative career preparation studies. To understand the occupational competencies required in vocations, students will have access to resource people and to information that will help them select a career. This cooperative approach to the involvement of community personnel is designed to broaden the students' educational background and perspective of possible career paths.

Development of skills and talents is the primary purpose of the practical experiences. Courses that comprise the specialty area of study must be directly related to occupational requirements for future employment and to the related programs offered at colleges and Provincial institutes.

Each course is divided into units and modules with student experiences described in terms of learning outcomes. Students will have the opportunity to explore a wide variety of core skills in an occupational field and the expected performance levels will be identified from the curriculum outline.

Grade 12: Student attendance in these courses will lead to the acquisition of skills and talents which may qualify them for entry level employment in related occupations and/or for advanced standing at a post-secondary institution. Emphasis is on career preparation; not on training for specific jobs. As students build on the earlier experiences from grade 11, they will be better prepared to focus on their future career goals.

Classroom experiences will be supplemented by cooperative career preparation studies which provide for community based learning external to the school. Teachers in each career preparation program will arrange with employers in the community for each student to acquire practical experience and will then conduct visitations to the training station to assess this learning experience. The external practical component of the program must be scheduled for a minimum of 100-120 hours with a well defined training plan. The personal contact between teacher/employer/student will strengthen the program. Teachers should assume the responsibility for coordinating the activities both at the school and the training station.

3.4 Definitions

Career Preparation Program: A Career Preparation Program is defined as a selection and arrangement of courses in general education subjects and courses in major vocational fields to form a systematic pattern leading to graduation from a senior secondary school with advanced admission to a post-secondary program and/or direct entry to employment. Requirements to complete a program consists of six approved specialty courses (including cooperative career preparation studies) together with prescribed constant courses and electives to meet the criteria for secondary school graduation in British Columbia.

Career Preparation Program Teacher: A suitably qualified teacher employed by a school to teach a specialty subject and who, in addition, has the responsibility of coordinating and supervising related job experience.

Cooperative Career Preparation: The process of integrating the instructional, administrative and organizational activities of career preparation experience into a cooperative relationship between the school and the community.

Cooperative Education: A comprehensive term used to describe shared responsibilities and roles of teachers and employers in the provision of educational experiences that will prepare people for employment.

District Work Experience Coordinator: A teacher employed by a school board to direct, coordinate and supervise work experience and cooperative career preparation studies for the whole school district.

Training Plan: A written outline indicating what is to be learned by the student at the training station and what is to be taught in the school.

Training Sponsor: The individual at the training station directly responsible for the supervision of the student's activities external to the school.

Training Station: The location external to the school where the student receives training related to an individual career development plan.

Work Experience: Activities at a training station undertaken by a student as an integral part of an approved school program under the cooperative supervision of a qualified work experience teacher and an employer.

3.5 Definition of Curriculum Terms

Learning Package: A self-contained package, comprised of a series of modules sequenced in a logical way to progressively build knowledge and skills which will enable attainment of an intended learning outcome. The package should include a diagnostic pretest and a posttest.

Learning Outcome: A learning outcome stated in behavioural, measurable, or performance terms is an assertion of what is expected to happen as a result of learning having taken place. The statement usually defines what the activity and subject matter will be, the conditions under which it will take place, and the minimum performance standard required. The purposes of the learning outcomes are:

a. The student and teacher know what is expected upon completion of an instructional unit.
b. The most appropriate instructional materials and strategy can be chosen in order to ensure achievement of the learning outcome.
c. The statements provide a basis for measuring student progress related to the learning tasks.

Module: A combination of goals, instructions, content, and activities which facilitate the development of a desired competency. Each module focuses on a specific job task and learning outcome. Modules may focus on the need for essential knowledge, or hands-on practice, or integration of knowledge and skills to perform a job task.

Modules for Self-paced Instruction: The students can work through the modules, with the supervision of the teacher, at their own pace, instead of an imposed time schedule. The module is completed when the student demonstrates mastery of the intended learning outcome.

Vocational Education: The educational experiences offered at the secondary and post-secondary school levels that provide individuals with skills and talents to develop capacities for: (a) entry level employment, or (b) upgrading in an occupation, or (c) retraining in a new occupation, leading to qualifications for employment requiring less than a university degree upon completion of the program.

PART 4.0 GOALS OF CAREER PREPARATION PROGRAMS

4.1 Review Process

From a review in 1977 of the effectiveness of secondary programs to adequately prepare students for future employment, three conclusions were made:

a. There was a need to undertake a more efficient and relevant use of student time for the grade 11 and 12 years.
b. There was a lack of realistic orientation to the world of work and this was deemed to contribute to the poor employment situation for many students.
c. There was evidence from the Report of the Commission on Vocational, Technical and Trades Training in British Columbia, (1977) that more effective vocational training was needed in grades 11 and 12 to adequately prepare some students for direct entry into the work force.

Pilot programs in career preparation were undertaken in various areas of the province between 1977 and 1980 and the results of these programs supported assumptions that:

a. in addition to the present provisions for secondary school graduation, the school may extend the opportunity in grades 11 and 12 for a student to gain marketable skills and/or advanced standing in post-secondary courses or programs;
b. the provision of employment skills should not reduce the percentage of graduating students when compared to the school population generally;
c. the provision of marketable skills should have a positive effect upon the graduates' employment opportunities when compared to the total graduate population;
d. the monitoring of the pilot projects would provide information on the effects of the projects on the number of students choosing to further their full time studies;
e. the pilot projects would have a positive effect upon the total integration process between secondary and post-secondary education (including the Apprenticeship Branch of the Ministry of Labour);
f. the funding arrangements for the pilot project would provide the information necessary to establish a rational system of funding if the projects are extended to the whole province;
g. monitoring of the pilot projects would provide information on the effects of the project on:
    i. the basic comprehensive graduation programs offered in the schools;
    ii. the standards and expectations of post-secondary courses and programs with respect to secondary schools, and
    iii. the possible areas of conflict regarding the responsibilities of the secondary school and teachers and the post-secondary institutions and instructors.

4.2 Recommendations

In 1980, the Ministry of Education agreed to the recommendations of a steering committee that the career preparation program receive formal endorsation. Four goals for the program were established. The Ministry of Education should:

a. foster career training in the schools without sacrificing the general education function of the school,
b. increase the articulation of programs between secondary schools and post-secondary institutions through joint development of relevant curriculum units in career and vocational areas,
c. define the career preparation program and monitor career training in order to assure the status, quality and provincial credibility of such training, and
d. develop, through joint consultation, the administrative framework which will guide the general and specific conditions for course recognition by post-secondary institutions.

The primary goal for the career preparation program is to provide students at secondary schools with the opportunity to gain increased awareness of career and employment needs without sacrificing the general educational function of the schools. Courses are designed to integrate with the business and industrial community and with post-secondary colleges and Provincial institutes.

4.3 Student Outcomes

Goals for student outcomes in career preparation programs are:

a. to develop competencies and marketable skills for some individuals to prepare for an entry level job;
b. to acquire prerequisite qualifications for some individuals who may pursue further training and/or advanced placement in an integrated program at a post-secondary school;
c. to attain skills necessary to locate, read and comprehend material or literature related to their particular field of career interest;
d. to attain a basic level of skills and talents needed for employment in a particular vocation (occupation);
e. to achieve the competencies necessary for critical thinking and problem solving in a specialized area of study;
f. to develop self-discipline for constructive work and study habits;
g. to develop feelings of pride and self-confidence in achievement and progress;
h. to acquire a sense of respect and concern toward personal property as well as the property of others;
i. to increase personal and social competencies and acquire a sense of social responsibility; and
j. to increase cooperative work skills to attain group goals.

PART 5.0 ORGANIZATION

A career preparation program has been defined as a selection and arrangement of courses in general education subjects and in major vocational fields to form a systematic pattern leading to secondary school graduation with qualifications for direct entry to employment and/or advanced admission to a post-secondary school program.

5.1 Goals and Outcomes

General goals are provided for each program, each course, and for each module within the course. These goals are intended to provide general direction to the teachers, students and employers to indicate the broad parameters at each level.

Learning outcomes are specified for each module in terms that will indicate the performance levels that students are expected to achieve for completion of each unit and course. Criterion referenced tests may be developed by teachers to ensure that projected competencies for students are similar in various regions of the province.

5.2 Program Requirements

Requirements to complete a career preparation program consist of four constant courses, six provincially approved specialty courses and at least two additional elective courses for a minimum of twelve courses to meet the requirements for secondary school graduation. Within the six specialty courses of approximately 120 hours each (minimum of 700 hours), students will complete units in cooperative career preparation studies in grades 11 and 12.

Courses in the sample outline that follows for a student program in grades 11 and 12 should be regarded as the basic requirements for graduation with a career preparation specialty. There will be situations where it will be necessary, and to the student's advantage, to apply the elective courses to subjects as mathematics, physics or general business to acquire adequate preparation for a vocational choice or for requirements of a post-secondary institution. Students planning on a career in trades related to general mechanics will benefit from a mathematics course while another student may require a business education course for a career in the hospitality industry. The student program should be organized to provide the most useful background for entry into a chosen career field.

CAREER PREPARATION PROGRAM FOR

GENERAL MECHANICS

CONSTANTS (4)	English 11 English 12 Social Studies 11 Physical and Health Education 11	
SPECIALTY (6)	C P 11 General Mechanics) C P 11 General Mechanics) C P 11 General Mechanics)) C P 12 General Mechanics) C P 12 General Mechanics) C P 12 General Mechanics)	Minimum of 700 hours
ELECTIVES (4)	4 courses	

SECONDARY SCHOOL REQUIREMENTS - completion of a minimum of twelve courses for graduation. For further details, refer to the Administrative Handbook 1981.

5.3 Guidelines

The fundamental purpose in the foregoing organization is to ensure that students complete the general education constants and acquire some specialized experiences that will prepare them for employment or continuing education. When students enter a career preparation program in grade 11, they will concentrate on the acquisition of core skills related to an occupational field or industry. Development of personal and interpersonal skills and an orientation to the organization of business and labour will be an integral part of the learning process.

In grade 12, the students will move from the core skills acquired in grade 11 to more specific skills related to an occupational/vocational choice. During this school year, students will gain practical experience in community based learning activities at a job site for a minimum period of 100 - 120 hours. Teachers of the specialty courses will arrange for the external practical experience with various business firms and visit each student at the training station as part of the cooperative career preparation studies. Teachers should prepare information that will assist the employer in assessing the performance of the student at a training station.

Practical experience is an integral part of the educational program for students enrolled in career preparation. School credit is granted for the cooperative career preparation component at a job site but the student should not be paid wages while working under the supervision of school personnel. The student must not displace a regular employee and should recognize that there is no assurance of a job at the conclusion of the training period.

In addition to Workers' Compensation Board coverage for school arranged cooperative career preparation with an employer, a student or their parents may choose to purchase personal accident insurance. Any student under the age of majority requires parent or guardian approval in writing before participating in a learning situation external to the school. Further details and approval forms are available from the Ministry of Education (Career Programs).

5.4 Advisory Committees

Advisory committees can perform a valuable role in the development of career preparation programs. The advice and guidance provided to teachers by representatives of employers, employees and the community is extremely important. The function of the advisory committee is not to establish policy or to make financial decisions but this voluntary group can provide a vital communication link between the school and the community. Recommendations for action will represent the best advice available to plan viable programs for the benefit of the student.

Functions of advisory committees as they relate to career preparation programs are:

a. to assist in determining and evaluating the needs which the program is designed to meet;
b. to assist in defining relevant program objectives;
c. to assist in promoting public awareness of the instructional program by colleges, unions, professional associations, employers and appropriate community groups and government;
d. to assist in securing community support of the instructional program, including formal recognition by industry and regulatory bodies, as well as government approval;
e. to assist in the placement of graduates; and
f. to assist in obtaining and coordinating student field experience in the community.

Advisory committees should have representation, where appropriate, from the secondary school, school district, local industry, unions or related associations, and post-secondary institutions in the region. A suggested composition for the advisory committee would include: Superintendent of Schools or representative; school principal or representative; teacher(s); college or Provincial institute representative; employer representative(s); employee representative; district career coordinator (work experience coordinator); labour representative; school trustee.

5.5 Cooperative Education

Education is currently viewed as the way to prepare people for their lifework and the need for experiential learning is evident. One of the proven methods for the student to develop responsibility and dependability within the educational process is to arrange for organized learning experiences with an employer. Opportunities can be provided for the student to gain practical experience with an employer under the concept of cooperative education. The primary purpose of cooperative education is to provide the student with planned and evaluated practice/experiences which will enhance the integration of theory learned in the classroom with pragmatic requirements of the work situation. Acceptance of this premise implies that there are definite procedures that must be followed for implementing cooperative education practices.

Primary responsibility rests with the teacher to:

a. design an overall plan for the student to participate in cooperative education;
b. involve the advisory committee to validate proposed plans before implementation;
c. consult with teachers, counsellors and CHOICES specialists concerning career goals for students;
d. establish and maintain training stations;

e. outline parameters of student experiences to be provided by employers;
f. develop a training plan of proposed experiences and how these activities relate to school based courses;
g. provide guidelines that may be used by the employers;
h. outline the legal requirements that apply to students for compliance with guidelines from Ministry of Education, Ministry of Labour and the Workers' Compensation Board;
i. contact the local office of the appropriate labour organization (where applicable);
j. conduct visits with each student at the training stations; and
k. determine and implement the evaluation procedures that will be used for each student in the course.

In conducting the cooperative education component of a career preparation program, the teacher coordinator is of vital importance to the operation of a successful plan. Detailed planning and evaluation procedures will enable all the affected parties to contribute to the learning experiences of each student. All activities between the school and a business must be coordinated in a manner that allows maximum opportunity for each student to practice what they learn. When evaluation techniques are well designed, the teacher and the advisory committee will be able to analyze the results and consider changes for improving this aspect of experiential learning.

Educational planning for cooperative career preparation experiences are incorporated as an integral part of this curriculum guide. The provision of the cooperative career preparation studies cannot be implemented as a separate component in isolation to approved courses. When people from the education system develop a cooperative approach with the business community to the learning needs of students, the transition from school to work will be more effective for all students who participate in cooperative career preparation.

Teachers of career preparation programs will need to coordinate their planning with a district staff person assigned to coordinate activities between the schools and employers. In large school districts there will be greater need to develop procedures between schools to organize the efforts of teachers who provide general work experience for students in any subjects and for students in the cooperative career preparation studies. The district coordinator will be responsible for maintaining consistency in policy and ensuring that all legal requirements are complied with according to school board policies.

PART 6.0 EVALUATION

6.1 Evaluation Process

One of the important components of the Career Preparation Program that is critical to the successful acceptance by the community and post-secondary institutions is the matter of evaluation. Criteria within a curriculum guide for student performance must be established to indicate student progress. Evaluation must be consistent to provide the necessary documentation of the student achievement. Each program is organized in units and modules to indicate expected performance in terms of intended learning outcomes. On the basis of the statements concerning student performance, various testing methods may be employed to validate the achievement for the benefit of the students, parents, post-secondary teachers and potential employers.

Included in the evaluation process will be tests to consider progress in the affective, cognitive, psychomotor and perceptive domains. Terminal performance should consider theoretical knowledge, practical skills and the personal and interpersonal attributes that contribute to successful employment. Students are expected to affirm their understanding of the learning outcomes for each module through valid expression of their skills and talents. Indications of their cooperation with others and attitudes to work and future learning needs are an important consideration of the evaluation process for career preparation.

Students can be encouraged to judge their own progress in relation to the established objectives for the modules comprising a course outline. Rigid time limits for each module are not prescribed since there is recognition of the variable abilities of individuals to acquire skills and talents necessary for acceptable performance.

Learning outcomes and criteria have been stated according to the perceived needs of the students, employers and instructors of related courses and programs in colleges and Provincial institutes. Evaluation techniques and methods must be flexible but the results should indicate the standard of performance that has been achieved. Collaboration between teachers at secondary schools and instructors at post-secondary institutions is essential to ensure that the goals of the program are being met to effectively integrate courses which comprise each career preparation program. Regular meetings of advisory committees will help facilitate reviews of the goals and objectives and ensure that the interests of the concerned individuals are being considered.

Evaluation processes should be designed to assist students to acquire the necessary skills and talents that will be useful for a vocational goal. Performance criteria can be reviewed at appropriate intervals to ensure that standards are realistic and that employers and post-secondary instructors are satisfied with the graduates of the programs. Students should acquire a broad view of an employment field before they select an occupation that will require concentrated study and preparation. Qualifications for one job are often related to other jobs and the evaluation process must be designed to enhance student growth for employability in related occupations. Procedures for testing in any career area should help and not hinder student growth in the realization of personal goals that will lead to gainful employment. Evaluation should clarify the capabilities of individuals and provide essential information to students, parents and employers.

6.2 Determination of Performance Criteria

Part of the learning process concerns the evaluation process and various methods may be used by teachers to determine the progress of students. Teacher strategies will be employed in the affective, cognitive, psychomotor and perceptive domains. Performance levels in the cognitive domain will usually be assessed by formal written exams. In addition, there will be procedures to determine performance in the practical demonstration of abilities and other tests that will require the professional expertise of the teacher to assess performance levels. There are at least six evaluation procedures that teachers may apply to assess student progress toward the learning outcomes in this curriculum guide.

A bank of evaluation resource materials, including curriculum referenced tests and procedures for evaluating manipulative skills, will be developed and made available on a provincial basis to assist the classroom teacher and to serve as external benchmarks. At the same time, within the six categories below, it is expected that teachers will develop and share other materials that may be applied to the instructional process.

- Comprehensive written examination (on the cognitive level for all aspects of subject matter)
- Practical demonstration (on manipulative skills)
- Oral examination (on verbal descriptions of processes)
- Team or group examination (on activities that involve two or more students)
- Observation
- Questionnaire/opinionnaire instrument (on reactions from cooperative education experiences)

CURRICULUM FORMAT

The following sections of this curriculum guide consist of:

- Aims and purposes for students enrolled in a Career Preparation Program for General Mechanics,

- Course/unit general aims which indicate the general knowledge/ skill required to achieve a satisfactory level of performance,

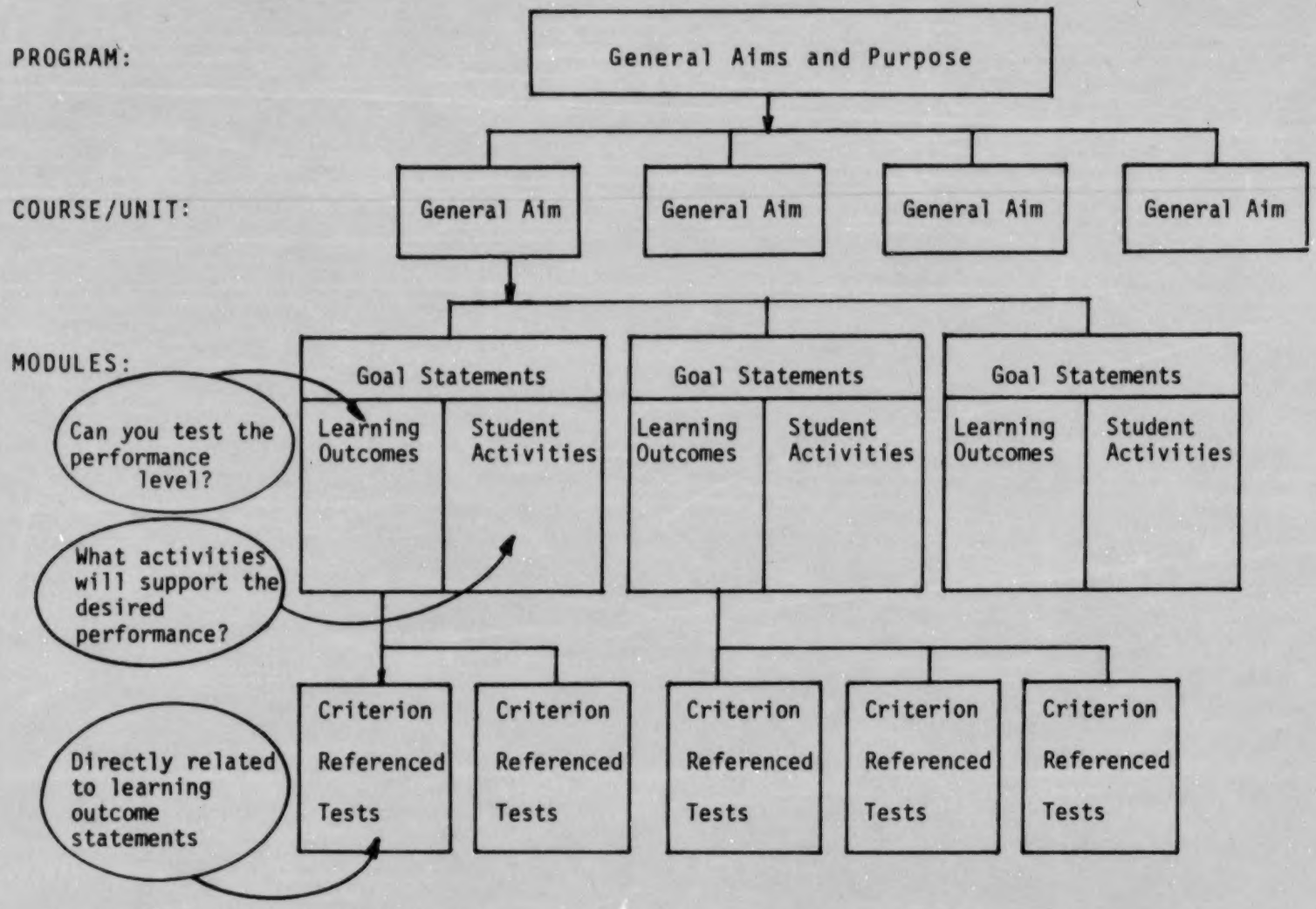
- Goal statements and learning outcomes for each module with student outcomes for the expected levels of achievement,

- Student activities designed to support the learning outcomes of each module, and

-Bibliography and resources that may be used to assist the student achieve the learning outcomes.

The learning outcomes specify the minimum levels that are essential for the satisfactory completion of each module. This information is compiled under particular topics but the sequence of teaching any aspect of the program is the responsibility of the teacher. Professional expertise should be applied to plan instruction and to expand and enhance student performance without undue reliance on tests to measure cognitive knowledge. In the process of evaluation the teacher should consider all aspects which contribute to the effective mastery of skills for each occupation. Evaluation should include assessment of skills, knowledge, talents, personal and interpersonal behaviour related to a vocation. The development of attitudes toward the work ethic should be considered in the provision of experiences leading to successful employment.

Essential components to support the learning experiences outlines in courses will be cooperative career preparation studies. Teachers should develop procedures with business personnel in the community to ensure that cooperative activities at school and in the community are provided for all aspects of the career preparation program. Organized learning experiences away from the school building should be related to particular goals and learning outcomes stated in the following sections of this curriculum guide.


PROGRAM:
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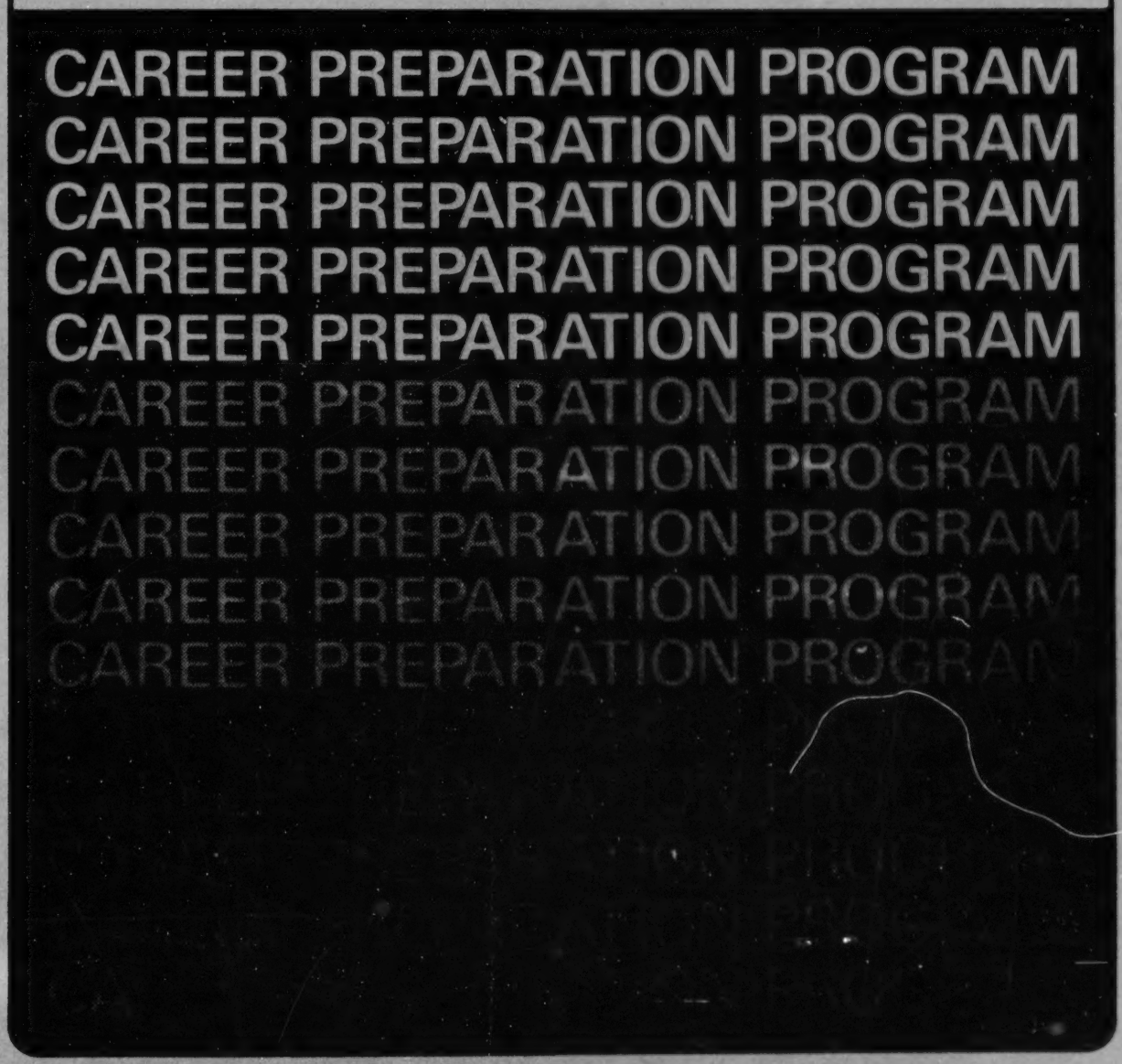
COURSE/UNIT:
General Aim
General Aim
General Aim
General Aim
MODULES:
Goal Statements
Learning Outcomes
Student Activities
Goal Statements
Learning Outcomes
Student Activities
Goal Statements
Learning Outcomes
Student Activities
Can you test the performance level?
What activities will support the desired performance?
Directly related to learning outcome statements
Criterion Referenced Tests
Criterion Referenced Tests
Criterion Referenced Tests
Criterion Referenced Tests
Criterion Referenced Tests

Section Two
CP 11 - General Mechanics



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C P 11 - GENERAL MECHANICS

The primary aim of the General Mechanics program is to provide learning experiences for students to develop marketable skills for employment or to qualify for advanced standing in a related program at a post-secondary college or provincial institute. Part of the program includes an integral component of cooperative career preparation studies which is designed to orient students to the requirements of employment through work study experiences. This component can be organized by the specialist teacher to use various resource persons who can provide the expertise necessary to help students understand aspects of career preparation studies.

Students should acquire knowledge of:

a. career opportunities and educational requirements in general mechanics vocations;

b. basic practices in the development of generic skills;

c. theory and operation of autombiles, heavy equipment, small engines and diesel engines;

d. concepts applicable to troubleshooting techniques for mechanical vocations;

e. practice of clean, safe and orderly work habits;

f. employment opportunities and occupational qualifications needed for initial job entry levels;

g. continuing education opportunities at various post-secondary institutions;

h. job satisfaction concepts and an appreciation of work ethics for successful employment;

i. attitudes and skills required for entry and advancement in occupations related to general mechanics; and

j. trends and technological developments that may affect people in the general mechanics fields.

UNIT 1.0 COOPERATIVE CAREER PREPARATION (SCHOOL BASED)

Career planning and preparation involves a combination of educational experiences that will enhance the individual's personal development and provide practical experiences leading to a vocational field of interest. Cooperative educational experiences are designed to provide opportunities for students to become involved in career related experiences through community participation. In grade 11 the students will have opportunities to:

a. learn about career development within the course requirements,
b. observe employees at work in the community,
c. participate in discussions with resource persons from the community,
d. acquire knowledge of proven procedures for job searching and interviewing, and
e. become aware of educational requirements for particular careers.

These educational experiences are intended to be an integral part of the learning experiences within the career preparation program. Students will gain further experiences in cooperative education in grade 12 through actual work experience in the community.

General Aims

The student will:

a. gain practical assistance in making the transition from school to a career field of interest,
b. develop skills and abilities that are needed for employment in a career field of the student's choice,
c. be prepared to enter the world of work with an increased measure of competence,
d. develop respect for other people and the work that they do,
e. develop a systematic approach to solving problems,
f. participate in discussions related to career choice and life style to increase the student's awareness of the importance to health, happiness and economic security.

MODULE 1.01 CAREER DEVELOPMENT AND COMMUNICATION

Goal Statements

The learning experiences in this module are designed to help each student:

a. increase awareness of the job opportunities in the community;
b. gain insight into the aptitudes and skills required for various occupations;
c. develop a relationship between immediate experiences and decisions that influence their evolving career development;
d. understand factors that influence the choice of a vocation or profession;
e. develop suitable, realistic and personnally desirable career goals;
f. enter the world of work with increased measure of competence;
g. gain experiences in decision-making skills;
h. understand communication processes and barriers;
i. learn and practice good work habits for employment situations;
j. acquire skills in writing reports in a specified format.

Learning Outcomes	Student Activities
The student should be able to:	
1.01.01	
identify reasons that lead people to work	-consider why people work -discuss work ethic, social values, economic independence
1.01.02	
analyze and list tentative vocational objectives	-compare vocational family grouping of occupations

1.01.03 analyze factors to consider in career selection	-discuss reasons for people to work -examine job cluster charts -discuss educational requirements of jobs -identify factors to consider in career decisions -discuss career 'payoffs'
1.01.04 convey positive attitudes toward punctuality, honesty, courtesy, responsibility and cooperation	-discuss company losses due to theft, absenteeism, shoplifting -discuss employee responsibilities and personal relations
1.01.05 identify factors that influence the student's vertical and horizontal mobility in a selected career field	-analyze qualifications for job entry -use examples from industry
1.01.06 practice communication skills in an employment situation	-view films or read examples and react -discuss importance of clear communication
1.01.07 describe successful work behaviour - attitudes, skills and responsibilities	
1.01.08 participate and use communication skills in group interaction situations	
1.01.09 use non-verbal listening and attending skills	-listen to instructions and then act on them

1.01.10	
use verbal and non-verbal communication skills	-participate in small and large group discussions -listen to instructions and restate them accurately and interpret them
1.01.11	
list three things that influence how one makes a decision	-react to conflict situations -discuss communication techniques to resolve a conflict situation
1.01.12	
speak clearly and confidently in situations involving another individual or a group and using a telephone	
1.01.13	
participate and use communication skills in group interaction situations	-work with other students in class
1.01.14	
prepare a brief report or memo from prepared examples of occupational situations	-review and discuss types of reports used in various employment situations, e.g. accident reports, evaluation, communications, etc.
1.01.15	
prepare a report of a work situation in school	-discuss reports

MODULE 1.02 WORK ETHIC AND WORK OBSERVATION

Goal Statements

The learning activities in this module are designed to:

a. review the concept of 'work ethic' in relation to the economy,
b. provide each student with various methods of conducting observation (shadowing) session, and
c. increase the student's ability to interview and gather information from people.

Learning Outcomes	Student Activities
The student should be able to:	
1.02.01 describe positive work habits and attitudes	-class discussions -discuss job/career satisfaction
1.02.02 conduct an informational gathering analysis of a particular occupation	-discuss the nature of work tasks and social skills -examine impact of technology
1.02.03 prepare a brief oral report on a selected career that outlines advantages and disadvantages for employment in the field	-review social and economic aspects of various occupations -examine present and future demands for employment in particular jobs.
1.02.04 list the safety factors that are critical to a particular job	-consider training needs -discuss "external" dangers, and jobs with high degree of risk in maintenance, e.g. mine sites -research importance of "safety attitude" -categorize "risk" factors
1.02.05 list training requirements for three specific careers in area of interest	-use related resource information and sources of career information

MODULE 1.03 ORGANIZATIONAL STRUCTURES AND ROLE OF MANAGEMENT AND LABOUR

Goal Statements

The learning experiences in this module are designed to:

a. help each student relate individual jobs to various organizational structures,
b. provide examples of the inter-relationships of occupations and functions in a company related to mechanical trades,
c. help each student to understand the function and responsibility of management,
d. help the student recognize the role of the labour organizations in company operations,
e. orient the student to the respective roles of labour and management personnel,
f. provide the student with a brief overview of the process of contract negotiations,
g. increase student awareness of the contribution of labour to economic growth and development in the country,
h. provide information that outlines the contribution of the labour movement to the social and economic growth of the country, and
i. examine the organizational structure and development of the major unions.

Learning Outcomes	Student Activities
The student should be able to:	
1.03.01 prepare a chart to outline a typical company organization	-discuss the importance of various roles in a company -review organizational plan for small and large companies, identify "essential" positions
1.03.02 compare the essential differences between management roles and workers	
1.03.03 list some of the attributes of a manager and a leader	

1.03.04	
list some of the methods used to accomplish company goals	-discuss social and consumer goals and needs
1.03.05	
outline the steps that are followed for contract negotiations	-group discussions and guest speaker
1.03.06	
debate an issue concerning any of these topics: unionism, capitalism, equal rights, sexual equality or employee benefits	-discuss with resource speakers
1.03.07	
discuss the concept of the labour market in a career field and project conditions that would affect them	-discuss job stability -project employment needs and the role of labour
1.03.08	
list the procedures to be followed in a grievance procedure	-use resource people from labour organizations
1.03.09	
define common terminology, e.g. shop steward, local, grievance, negotiation process	-review prepared materials -read case studies (print, tape)
1.03.10	
describe background for developments in the labour movement	-discuss handouts and films
1.03.11	
make a flow chart on the labour organizational structure.	-group discussions and activities

MODULE 1.04 WORKING CONDITIONS AND LABOUR LEGISLATION

Goal Statements

The learning experiences in this module are designed to help each student:

a. become familiar with common requirements and responsibilities of an employee,
b. become aware of employee/employer rights under legislation,
c. develop an awareness of the legislative process and laws that protect employee rights, and
d. become familiar with the sources of information relative to employee rights and responsibilities.

Learning Outcomes	Student Activities
The student should be able to:	
1.04.01	
list examples of proper care of company equipment and materials	-differentiate between routine maintenance and careless breakage
1.04.02	
list reasons for employee punctuality in five occupations	-discuss different occupational requirements
1.04.03	
define 'overtime' in two different occupations	-discuss labour laws -relate concept of overtime to salary
1.04.04	
complete various types of applications forms, income tax forms, time cards etc.	-practice completion of basic forms that employees use -calculate salary by day, week, month and year
1.04.05	
analyze desirable and non-desirable considerations that relate to a specific geographical location for employment	-discuss particular jobs in urban, rural and remote areas

MODULE 1.05 JOB SEARCH SKILLS AND JOB INTERVIEWS

Goal Statements

The learning experiences in this module are designed to help each student:

a. become familiar with a disciplined and methodical approach to the job search process,
b. review examples of proven processes in preparing resumés and qualifications briefs,
c. analyze some non-traditional job search skills,
d. prepare for job interviews,
e. practice methods of conducting job interviews, and
f. review and clarify various methods of arranging and participating in an interview for employment.

Learning Outcomes	Student Activities
The student should be able to:	
1.05.01	
identify the 'hidden' job market	-review methods used by people to find jobs
1.05.02	
complete two resumé outlines for simulated situations	-use various formats, chronological, functional, qualifications brief -organize information in an approved format and style
1.05.03	
draft a covering letter for resumé	-write letters and compare with others in class
1.05.04	
examine procedures used to screen applicants for employment	-discuss various company personnel procedures
1.05.05	
follow detailed instructions to complete an application form	-use and complete sample application forms

1.05.06	
outline basic steps to follow for initial contact with an employer	-prepare a letter that requests an application form -discuss pros and cons of contacts by phone, letter or interview
1.05.07	
apply successful job search techniques	-use resource personnel from C.E.I.C. -list agencies and organizations that may be contacted for jobs
1.05.08	
list employment opportunities for a mechanical trades occupation from a search of: a. newspaper classified sections b. personal contacts c. informational interviews (friends) d. Canada Manpower	-discuss terms and occupational titles for various occupations -interpret information from printed employment want ads
1.05.09	
practice interviewing skills	-tape a simulated interview situation with other students -demonstrate appropriate manners and etiquette -writing letters of thanks where appropriate
1.05.10	
prepare a job prospect card	-review examples and complete a sample

MODULE 1.06 FIELD TRIPS AND RESOURCE SPEAKERS

Goal Statements

The learning experiences in this module are designed to:

a. provide the opportunity for occupational observation by utilizing the resources of the community, and
b. involve the community in the educational career development of students.

Learning Outcomes	Student Activities
The student should be able to:	
1.06.01	
write a synopsis of a film or article on a career field of the student's choice	-view films or articles and discuss in class
1.06.02	
contact and arrange for a guest speaker to visit the class for a discussion	-discuss procedures and act as host/hostess
1.06.03	
interview three employers to record opinions and requirements that are deemed to be important to effective employment	-conduct interviews and make oral report to class
1.06.04	
prepare an outline of specific items on working conditions that should be observed during a plant visit	-complete written evaluation outline

MODULE 1.07 EDUCATIONAL REQUIREMENTS FOR CAREER PLANNING

Goal Statements

The learning experiences in this module are designed to:

a. enable the student to enter the world of work with an increased measure of competence;
b. help each student increase their awareness of a wide variety of career and educational options; and
c. provide the student with an understanding of opportunities for continuing education - university, college or Provincial institute programs.

Learning Outcomes	Student Activities
The student should be able to:	
1.07.01	
identify the most powerful reinforcers to their proposed career choices	-class discussions
1.07.02	
list the names and locations of post-secondary institutions offering courses in three career fields	-review entry requirements, program offerings, length of terms for specific courses -select one career field and prepare an educational plan for report to class
1.07.03	
demonstrate an ability to define career ladders and how to reach more advanced positions	-review a line diagram of a company organization pattern -work from prepared samples to design a career ladder in a particular field of interest -interview people at different levels in a career area and assess opinions regarding job satisfaction

UNIT 2.0 SHOP PRACTICES, HUMAN RELATIONS AND SAFETY PROCEDURES

General Aims

The student should develop and apply positive attitudes toward the application of standard shop practices, interpersonal relations and observance of safety rules and regulations.

MODULE 2.01 SHOP RULES AND PRACTICES

Goal Statements

The learning experiences in this module are designed to:

a. help enable the student to acquire sufficient skills to identify, select, maintain and to safely operate shop equipment for the service and repair of mechanical vehicles.
b. increase student awareness of the construction and operating principles of various items of shop equipment;
c. provide situations that enable the student to demonstrate quality workmanship; and
d. help each student acquire a sensitivity for determining stress and strain in certain lifting operations.

Learning Outcomes	Student Activities
The student should be able to:	
2.01.01	
identify safety and health hazards	-locate safety and health equipment and discuss reasons for safety and health protection
2.01.02	
demonstrate good housekeeping habits	-list areas that require housekeeping and methods used
2.01.03	
maintain a clean and safe work area	-review both safe and unsafe work areas

2.01.04	
use safety glasses, shields, guards, and other protective clothing according to prescribed standards	-discuss proper applications of protective equipment
2.01.05	
identify and use proper cleaning agents	-study and discuss the characteristics of different cleaning agents and their applications
2.01.06	
safely handle and store cleaning agents	-examine safety storage provided -consider applicable regulations
2.01.07	
describe the design and explain the operating procedures for: a. hoisting and jacking equipment - mechanical - electrical - hydraulic b. general shop equipment - safety stands - hydraulic jacks and presses - cleaning tanks - air compressors and equipment - clamping devices - grinders - drill presses	-identify hazards inherent to equipment operation -find capacity ratings of equipment -study information on purpose, types, styles and application of hoisting equipment -discuss function and composition of major components of hoisting equipment -prepare list of capacities of lifting and supporting
2.01.08	
explain first aid for common injuries; lay out procedure of response in any injury for your work situation	-discuss basic procedures for reporting and disposition of injuries
2.01.09	
state the basic steps to follow in filing a claim with Workers' Compensation Board	-discuss the importance of W.C.B. and their role in worker safety

2.01.10 list examples of legal protection for employees within Workers' Compensation Board	-discuss legal role of W.C.B. -consider limitations of 'First Aid' and importance of adequate training before treating injured persons

MODULE 2.02 HUMAN RELATIONS AND PERSONAL ATTRIBUTES

Goal Statements

The learning experiences in this module are designed to help each student:

a. develop an awareness of their own potential, a sense of pride in accomplishment and confidence in their own ability;
b. develop an awareness of appropriate standards of human relations for various occupations;
c. become familiar with techniques for improved interpersonal relations;
d. develop positive attitudes in relations with teachers and students;
e. appreciate the ongoing importance of good human relations;
f. make an inventory of interests and capacities;
g. develop a sense of personal identity and worth;
h. consider the theories of perceiving people as individuals rather than identification by traditional sex roles in society;
i. prepare information regarding interests, temperaments and aptitudes required for various jobs;
j. recognize the importance of appearance and personal ethics to employment success; and
k. become aware of their own individual values and reactions toward people, situations and themselves.

Learning Outcomes	Student Activities
The student should be able to:	
2.02.01	
exhibit positive behaviour towards other students	-role playing -display approved techniques for interpersonal relationships
2.02.02	
display acceptable manners in all activities	-discuss need for appropriate manners

2.02.03	
demonstrate individual differences in perception	-use examples of good and poor relations by employers and employees; teachers and students
2.02.04	
complete a self-appraisal outline on personal traits and attitudes	-discuss importance of personality, attitudes and health to occupations -assess personal traits and talents
2.02.05	
assess strengths, capabilities and weaknesses of people	-consider and discuss in relation to employment roles -discuss need to conform in specific situations -review importance of health for employment -list personal attributes of people in columns of positive and negative
2.02.06	
use particular skills necessary to gather, process and act upon information about self in relation to their environment	-discussions of self-development
2.02.07	
recognize the importance of standards in appearance, dress and grooming, manners; and correct use of the English language	-observe films -review safe working conditions concerning dress
2.02.08	
list factors that influence discrimination, i.e. race, religion sex	-discuss equality of individuals -react to examples of prejudice -discuss ways to overcome discrimination

2.02.09 identify five important reasons for appropriate dress for an occupation	-group discussions
2.02.10 provide an example of a conflict situation created by employee/ employer attitudes toward dress	-group discussions

MODULE 2.03 GENERAL SHOP ADMINISTRATION

Goal Statements

The learning experiences in this module are designed to:

a. provide each student with a working knowledge of fundamental principles of shop systems, and
b. help each student recognize the need for efficiency in shop administration procedures.

Learning Outcomes	Student Activities
The student should be able to:	
2.03.01	
outline tool check out system in use	-become familiar with area for tool storage and check out system
2.03.02	
recognize areas where specific types of work may take place	-sketch a simplified shop layout
2.03.03	
conduct responsibilities during clean up period	
2.03.04	
list responsibilities required to maintain assigned area	

MODULE 2.04 EMERGENCY PROCEDURES (FIRE AND MEDICAL ROUTINES)

Goal Statements

The learning experiences in this module are designed to:

a. introduce the student to approved processes for dealing with emergencies in shop situations; and
b. describe the basic operation of four types of fire extinguishers (A B C D)

Learning Outcomes	Student Activities
The student should be able to:	
2.04.01	
demonstrate proper procedures for assigned emergency situations	-discuss common injuries -review available safety films and procedures
2.04.02	
distinguish between various classes of fires	-in group activities, use the correct fire fighting equipment and describe correct use of an oil fire (in a controlled environment)
2.04.03	
use appropriate fire extinguishers on different types of fires	-discuss school emergency exit procedures -practice prescribed exit procedures -inspect any given piece of fire fighting equipment and state the type of fire on which it may be used -review locations of extinguishers (refer to sketch of shop layout)

2.04.04 identify basic first aid procedures and telephone numbers for emergency assistance	-locate the required first aid equipment and discuss use
2.04.05 describe the basic operation of four types of fire extinguishers (A B C D)	-examine all fire extinguishers

UNIT 3.0 TOOLS AND EQUIPMENT

General Aims

The student should develop an understanding of the proper use and care of tools used in the mechanical trades.

MODULE 3.01 USE AND CARE OF HAND TOOLS

Goal Statement

The learning experiences in this module are designed to help each student identify, select, use and maintain hand tools necessary for the service and repair operations in mechanical trades.

Learning Outcomes	Student Activities
The student should be able to:	
3.01.01 identify and select appropriate hand tools required for use in the service and repair operations in the mechanical trades	-use small tools for maintenance -list usage of hand tools
3.01.02 demonstrate a knowledge of metric and Imperial tool sizes	
3.01.03 explain the construction, safe handling and techniques of hand tools as: a. hammers, punches, prybars b. sockets, wrenches, pliers c. chisels, scrapers, files hacksaws, drills d. vises, clamps	-use hand tools: a. hammers, prybars, punches b. chisels, pliers, wrenches c. scrapers, files hacksaws d. sockets, screwdrivers e. clamp, vises

MODULE 3.02 PRECISION MEASURING TOOLS

Goal Statement

The learning experiences in this module are designed to help each student identify, select and become proficient in handling and in the application and interpretation of precision instruments (both S.I. metric and Imperial); i.e. outside micrometers, inside micrometers, depth micrometers, vernier calipers, dial indicators, feeler gauges, and calipers.

Learning Outcomes	Student Activities
The student should be able to:	
3.02.01	
state the necessity of precision measurements	-discuss why exact measurements are required
3.02.02	
describe the design and explain the operating techniques of: a. precision measuring devices -micrometers (inside, outside and depth) -small hole gauges -vernier calipers -telescoping gauge -straight edge -feeler gauge b. dial indicators -universal -cylinder gauge -connecting rod gauge -brake drum c. non-precision measuring devices -rules (tape, scale) -calipers (inside, outside)	-use measuring instruments (Imperial and metric): a. micrometers (inside, outside and depth) b. vernier calipers c. telescoping gauges d. straight edges e. small hole gauges f. dial indicators g. cylinder gauge h. universal i. connecting rod gauges j. brake drum -apply proper handling and manipulation techniques
3.02.03	
select proper measuring devices for specific jobs	-study and discuss the reasons and advantages of each instrument

3.02.04 distinguish between S.I. metric and Imperial instruments	-compare measuring increments and arrangement
3.02.05 demonstrate at least once, the use of each listed measuring tool (3.02.02) by taking bore and shaft sizes and calculating readings to arrive at a specific size or the amount of wear	-take practice readings on various bores, gaps and journals
3.02.06 convert fractions to decimal equivalents accurately in Imperial computations	-complete given exercises
3.02.07 service and maintain measuring devices.	-study and discuss the care and adjustments of precision measuring devices and proving the instrument

MODULE 3.03 USE AND CARE OF POWER AND MACHINE TOOLS

Goal Statement

The learning experiences in this module are designed to help each student identify, select, use and maintain power tools and their accessories necessary for the service and repair operations in mechanical trades.

Learning Outcomes	Student Activities
The student should be able to:	
3.03.01	
recognize the purpose, type and application of electrical and air power tools of the mechanical trades, i.e.: a. drill presses b. hand drills c. bench grinders d. hand grinders e. impact wrenches	-study and discuss power tools and accessories -discuss ferrous and non-ferrous metals on grinders
3.03.02	
explain and list the applicable safety practices to be observed when using any of the listed electrical and air power tools	-discuss importance of safety
3.03.04	
demonstrate the safe and proper use of any of the listed electrical and air power tools	-after instruction, use appropriate equipment -apply approved methods to maintain equipment in good condition

3.03.05 point out and list the care and service required for any of the listed electrical and air power tools (3.03.01)	-review manuals and assigned materials
3.03.06 secure work properly in preparation for drilling a hole	-review correct set-up of tool and work piece: a. methods of securing work b. methods of holding cutting tool c. pressure applied and angle of cut d. cutting speed and use of cutting oils e. regulating depth of cut
3.03.07 operate a drill press at the correct speed and feed	

MODULE 3.04 CLEANING EQUIPMENT AND AGENTS

Goal Statements

The learning experiences in this module are designed to:

a. help each student to identify and select the best cleaning procedures of mechanical parts relevant to their material composition; and
b. develop increased skills in the use of various techniques for cleaning equipment in the mechanical industry.

Learning Outcomes	Student Activities
The student should be able to:	
3.04.01	
apply appropriate safety precautions, i.e. protective clothing, gloves, face and eye protection, rubber apron and boots	-safely operate cleaning equipment available in shop
3.04.02	
recognize and use available cleaning equipment; i.e. steam cleaners, hot tanks, pressure washers, sandblasters and caustic solutions	-study printed materials and identify available cleaning equipment -consider safety aspects
3.04.03	
list various cleaners and the types of components or parts that can be cleaned with them	-study characteristics and types of cleaning solutions

MODULE 3.05 USE AND MAINTENANCE OF GENERAL SHOP EQUIPMENT

Goal Statements

The learning experiences in this module are designed to:

a. familiarize the student with the rated capacities for the safe operation and maintenance of hoisting equipment;
b. help each student use the general shop equipment in the mechanical trade in a safe manner; and
c. help the student acquire sufficient skills to identify, select, maintain and to safely operate shop equipment required for service and repair in the mechanical trades.

Learning Outcomes	Student Activities
The student should be able to:	
3.05.01	
perform various lifting, hoisting, jacking operations according to prescribed safety procedures within the safe operating limits	-conduct assigned tasks
3.05.02	
recognize and describe the operating principles of various stipulated items of shop equipment	-discuss aspects of available shop equipment
3.05.03	
conduct routine inspection and maintenance of shop equipment to prescribed performance standards	-conduct assigned tasks using shop equipment

UNIT 4.0 FASTENERS

General Aims

The student should develop an understanding of the range of fastening devices and the selection, installation and maintenance of them as required in the mechanical trades.

MODULE 4.01 TYPES OF FASTENERS

Goal Statements

The learning experiences in this module are designed to:

a. help each student identify and select most frequently used fasteners; and
b. increase ability to classify into categories various types of fasteners.

Learning Outcomes	Student Activities
The student should be able to:	
4.01.01	
identify and classify types of thread according to: a. size b. pitch c. thread series d. thread classed -metric -unified classes -Imperial	-study and discuss the reasons for using different types of fasteners -identify threads for a variety of fasteners from a large assortment
4.01.02	
identify and classify: a. types of bolts b. grades of bolts and application c. types of bolt heads, e.g. -hex -square -Allen -Phillips -fluted -fillister	-use pitch gauge, steel rule and caliper to measure bolts and nut size -compare common uses of bolts

4.01.03 identify and classify various types of nuts: a. square b. hex c. slotted hex d. castellated e. acorn f. pal g. interference h. self locking	-compare common uses of nuts
4.01.04 identify and classify types of: a. flat washers b. lock washers c. cotter pins d. snap rings e. lock plates f. lock wire	-compare common uses of washers and cotter pins

MODULE 4.02 OPERATION OF TAPS AND DIES

Goal Statements

The learning experiences in this module are designed to:

a. provide experiences for the student to make external/internal threads;
b. complete a bottoming thread procedure;
c. sharpen a drill bit correctly; and
d. emphasize use of both metric and Imperial threads.

Learning Outcomes	Student Activities
The student should be able to:	*Activities may be incorporated into projects as a gear puller, drill gauge, clamp, etc.
4.02.01	
select from a chart the proper drill bit for both a metric and Imperial example	-select from a chart correct tap drill size
4.02.02	
use correct cutting lubricant to tap a thread in a steel plate	-list precautions to take when tapping -tap a hole through steel plate
4.02.03	
tap a blind hole	-state procedures and list precautions to take when tapping a blind hole -drill a blind hole and use taper, plug and bottoming taps to tap threads in the hole
4.02.04	
use a thread die and thread a mild steel rod	-select appropriate die, use cutting lubricant correctly, apply thread to rod and try threaded rod into previously threaded plate

4.02.05 sharpen a drill bit correctly	-diagram the desirable angles that are needed on a properly sharpened drill -practise freehand drill sharpening
4.02.06 recognize the proper methods of removing broken studs	

MODULE 4.03 IDENTIFICATION, SELECTION AND APPLICATIONS OF PIPES, TUBING, HOSES AND FITTINGS

Goal Statements

The learning experiences in this module are designed to:

a. help each student distinguish between pipe, tubing and their fittings,
b. increase student ability to select the proper pipe, tubing or hose for a particular application;
c. provide student experiences to apply accepted techniques of cutting, bending, flaring, securing and routing operations; and
d. increase the student's ability to select the proper type of hose and fittings for a particular application or run.

Learning Outcomes	Student Activities
The student should be able to:	
4.03.01	
identify types of pipe and tubing	-select and identify various pieces or sections of pipe and tubing from a classroom resource assortment -differentiate between pipe and tubing
4.03.02	
identify types of pipe and tubing fittings	-identify and select tubing and respective fittings relevant to their application
4.03.03	
perform cutting, bending, flaring and simple routing operations to prescribed safety procedures	-discuss and perform cutting, bending, flaring and simple routing operations to prescribed safety procedures
4.03.04	
identify types of hoses	-select and identify hoses from a classroom assortment

4.03.05 perform joining, sealing, cutting, bending, flaring, securing and simple routing operations to prescribed safety procedures	

UNIT 5.0 TECHNICAL - READING, WRITING AND REPORTING

General Aim

The student should develop increased competency to use basic skills for reading, writing and reporting information related to mechanical vocations.

MODULE 5.01 RECORD AND INTERPRET SERVICE AND REPAIR INFORMATION

Goal Statements

The learning experiences in this module are designed to:

a. help each student develop basic skills in recording information according to established procedures, and
b. encourage neatness and legibility in all written work.

Learning Outcomes	Student Activities
The student should be able to:	
5.01.01	
interpret parts and service manuals and other reference sources	-review various service manuals
5.01.02	
distinguish between the major and minor index system of service manuals and other reference guides	-discuss use of index systems
5.01.03	
record information in a log book	-check on items such as hours, kilometres or miles, repair work completed, modifications made and work order numbers
5.01.04	
record checks and service completed on "check sheets"	-identify essential information

5.01.05 record work completed on service and report forms	-follow approved procedures to record basic information -use neat, legible writing -be accurate in transcribing
5.01.06 apply the needs of communication: a. listening b. reading c. writing	

MODULE 5.02 WRITE DAILY WORK SHEETS

Goal Statement

The learning experiences in this module are designed to help each student develop abilities to record and maintain an accurate accounting of work completed.

Learning Outcomes	Student Activities
The student should be able to:	
5.02.01 describe in appropriate terms, work performed during a day	-compare samples of worksheets
5.02.02 use correct English in verbal and written communications	-practice completion of daily work sheets
5.02.03 record information in a neat and legible format	
5.02.04 complete a basic 'time card' or record of work form	-compare various formats and need for accuracy and neatness

MODULE 5.03 RELAY INFORMATION IN WRITING

Goal Statements

The learning experiences in this module are designed to:

a. increase student abilities to use correct English in communication;
b. provide examples of communication applied to general mechanics vocations; and
c. emphasize need for neatness in relaying information.

Learning Outcomes	Student Activities
The student should be able to:	
5.03.01	
write clear directions to other people and verify interpretations	-role play positions
5.03.02	
complete a neat and legible report on an assigned reporting task	-at task completion, a short concise report is to be forwarded to the instructor for evaluation
5.03.03	
maintain a neat and legible notebook on activities	

MODULE 5.04 IDENTIFY MODEL, TYPE AND SERIAL NUMBERS

Goal Statements

The learning experiences in this module are designed to:

a. introduce each student to basic processes used in compiling essential information for records, and
b. develop appreciation for accuracy in gathering, recording and relaying information

Learning Outcomes	Student Activities
The student should be able to:	
5.04.01	
locate machine and vehicle numbers and record data on work sheet	-search for model numbers, types and serial numbers on available equipment
5.04.02	
interpret essential data from name-plates and identification plates	-discuss the meaning of terms used
5.04.03	
relate model numbers to manuals for the machine or equipment	-compare essential records of information to correct manuals

UNIT 6.0 MECHANICAL DRAWING CONCEPTS

General Aim

The student should develop skills to read, identify and interpret basic methods used for graphic representation of parts from manuals and drawings.

MODULE 6.01 SKETCH SIMPLE COMPONENTS

Goal Statements

The learning experiences in this module are designed to help each student:

a. develop skills in sketching simple components, and
b. increase ability to recognize parts and relate them to actual components.

Learning Outcomes	Student Activities
The student should be able to:	
6.01.01	
identify simple automotive parts from prepared drawings	-study and compare various drawings
6.01.02	
complete a sketch of a simple part in both pictorial and orthographic format	-use mechanical aids to "sketch" parts, e.g. squared paper, rule -complete pencil drawings by freehand method
6.01.03	
interpret various formats of graphic representation	-compare various drawings and interpret parts -examine exploded views, isometric views, cross-section views, etc.
6.01.04	
identify and label components	-add names to prepared drawings, e.g. master cylinder cross section

MODULE 6.02 IDENTIFY SCHEMATIC SYMBOLS

Goal Statements

The learning experiences in this module are designed to help each student recognize common schematic symbols used in mechanical trades.

Learning Outcomes	Student Activities
The student should be able to: 6.02.01 identify basic electrical and hydraulic symbols 6.02.02 trace the flow of oil or electricity on prepared diagrams	-study examples of the use of schematic symbols

MODULE 6.03 PARTS MANUALS AND EXPLODED VIEWS

Goal Statements

The learning experiences in this module are designed to:

a. help each student acquire competency in reading parts and repair manuals, and
b. increase abilities to read and recognize parts from exploded views.

Learning Outcomes	Student Activities
The student should be able to:	
6.03.01	
locate and select specific parts listed in a parts manual	-use parts manuals, e.g. any current ignition manual -locate proper part numbers -place a phone order
6.03.02	
identify specific parts from an exploded view	-study a variety of exploded view drawings

MODULE 6.04 READ SIMPLE DRAWINGS

Goal Statements

The learning experiences in this module are designed to help each student develop skills in "reading" drawings.

Learning Outcomes	Student Activities
The student should be able to:	
6.04.01	
identify basic shapes from simple drawings	-study various simple drawings of basic shapes
6.04.02	
select dimensions of parts from prepared drawings	-study parts drawings in both metric and Imperial dimensions

UNIT 7.0 STARTING AND RUNNING EQUIPMENT (MOBILE/STATIONARY)

General Aim

The student should develop awareness of the importance of performing a pre-start check before running the equipment. The use of safety tags and securing of equipment is essential to the learning activities in this unit.

MODULE 7.01 PERFORM PRE-START CHECKS (SAFETY)

Goal Statements

The learning experiences in this module are designed to:

a. develop student awareness of the importance of a pre-start check;
b. provide opportunities for the student to follow a prescribed pre-start check and recognize the importance of the process for both personal safety and for the safety of others; and
c. help each student be aware of damage that may result to equipment, components or buildings by not following a prescribed check list.

Learning Outcomes	Student Activities
The student should be able to:	
7.01.01	
list the possible personal safety hazards in failing to follow a prescribed pre-start check list	-discuss possible personal safety hazards in failing to follow a prescribed pre-start check list
7.01.02	
list potential safety hazards to other individuals that may be caused by failure to follow a prescribed pre-start check list	-discuss possible safety hazards to other individuals caused by failure to follow a prescribed pre-start check list
7.01.03	
list possible damage that may result to equipment and components by failure to follow a prescribed pre-start check list	-discuss possible damage that may result to equipment and components by failure to follow a prescribed pre-start check list

MODULE 7.02 USE OF SAFETY TAGS

Goal Statement

The learning experiences in this module are designed to assist the student to understand the need for using safety tags.

Learning Outcomes	Student Activities
The student should be able to:	
7.02.01	
describe the need for the use of safety tags	-discuss the need for the use of safety tags
7.02.02	
identify and report the procedure to follow when finding a safety tag on a piece of equipment	-discuss the procedure to follow when finding a safety tag on a piece of equipment
7.02.03	
identify the procedure to follow in checking a log book entry before pre-start routine.	-discuss the procedure to follow in checking a log book entry before pre-start routine
7.02.04	
identify basic reasons for pre-start aids	-discuss the needs for pre-start aids

UNIT 8.0 GAS WELDING OPERATIONS

General Aim

The student should gain experience with approved practices for the safe management and operation of gas welding equipment.

MODULE 8.01 IDENTIFY COMMON METALS AND THEIR CHARACTERISTICS

Goal Statements

The learning experiences in this module are designed to:

a. provide introductory experiences that will help the student to understand the characteristics of basic metals; and
b. help the student recognize uses and applications of common metals.

Learning Outcomes	Student Activities
The student should be able to: 8.01.01 demonstrate a working knowledge of characteristics of common metals	-discuss applied science, i.e. metaliurgy concepts a. types of steel b. types of iron c. hardening and tempering processes d. characteristics of ferrous and non-ferrous metals
8.01.02 outline essential precautions in dealing with heat treated steels	

MODULE 8.02 WELDING SAFETY PRACTICES

Goal Statements

The learning experiences in this module are designed to:

a. help each student appreciate the importance of applying safe practices in the use of gas welding equipment;
b. introduce the student to methods for checking gas welding equipment before operating on welding or heating tasks; and
c. increase student awareness of the characteristics of gases used for gas heating and welding operations.

Learning Outcomes	Student Activities
The student should be able to:	
8.02.01 explain the safety regulations for gas welding to insure a safe working environment	-study and discuss dangers of oil or grease - spontaneous combustion; consider: a. acetylene pressure should never exceed 15 P.S.I. b. cylinders must be in secured, vertical position c. importance of correct sequence and technique for lighting and shutting off torch d. proper ventilation e. hazards of Butane lighters present in welding area
8.02.02 identify and explain gauges on oxygen and acetylene cylinders and their respective maximum working pressures	-compare other fuel gases and gauges -refer to metric gauges, where available
8.02.03 explain the use of fuel gases as applied to welding, cutting and brazing	

8.02.04	
test gas welding equipment for leaks	-use soapy water
8.02.05	
explain current safety regulations in storing and handling gas welding equipment	-study resource manual
8.02.06	
identify personal protective clothing and equipment used in gas welding	-study manuals and teacher directives
8.02.07	
demonstrate a working knowledge of the fundamental principles of gas welding	-follow instructions on assigned operations
8.02.08	
describe the design and explain the function and application of the major components of gas welding equipment	-classify and use applied tools and equipment: e.g. a. hoses -fuel gas-red colored -oxygen -green colored b. welding apparatus -fire bricks -goggles, torch striker, tip cleaner -wire brush, pliers -gloves and appropriate clothing
8.02.09	
install and check operation of gas welding equipment, i.e. a. pressure b. hoses c. welding tips d. torches e. cutting attachments	-test for leaks -change gauges from empty to full tanks -select tips -change tips, clean orifices -open valves and set gauge pressures -drain hoselines and pressure gauges

8.02.10 select, adjust and maintain gas welding equipment, adjust correct pressures	-follow assignments
8.02.11 demonstrate safe practices in using, storing, and handling gas equipment	-study current safety regulations on storing and handling gas welding equipment

MODULE 8.03 CUT, BRAZE, WELD AND HEAT WITH GAS WELDING EQUIPMENT

Goal Statements

The learning experiences in this module are designed to:

a. increase student understanding of the fundamentals of using gas welding equipment; and
b. develop manipulative skills for gas welding, flame cutting and brazing with the gas equipment.

Learning Outcomes	Student Activities
The student should be able to:	
8.03.01 identify various methods used to join, weld and fire metals using gas equipment	-practice torch angles a. travel angle b. work angle
8.03.02 demonstrate proper use of gas welding equipment for joining metals and heating metals	
8.03.03 perform welding and brazing operations with standard gas equipment as applied to automotive products	-practice welding and brazing procedures: a. place workpiece on fire bricks b. set gas pressures c. select proper torch tip size and goggles (#5 or #6 lenses) d. filler rod should be similar to base material property and adequate diameter

8.03.04 demonstrate a working knowledge of the fundamental principles of joining metals	-follow assignments for operations of: - flame and burning characteristics a. acetylene b. methylacetylene propadiene (mapp gas) c. propane d. natural gas - types of flame a. neutral b. carburizing c. oxidizing
8.03.05 heat metal for shrink fits	
8.03.06 clean orifices with tip cleaners	
8.03.07 perform cutting operations on various thicknesses of mild steel with an oxyacetylene torch	-select proper size of tips for cutting -use various cutting attachments -prepare metal surface -position metal to control sparks -clean orifices with tip cleaners
8.03.08 demonstrate fusion welding and perform a destruction test on welded sample pieces of 16 gauge steel	-prepare sample pieces -prepare surfaces for welding -select correct tip size

8.03.09 perform a fusion weld for a corner joint	-practice welds on sample pieces
8.03.10 perform a fusion weld for a lap joint	-practice welds
8.03.11 perform a fusion weld for a butt joint	-practice welds

UNIT 9.0 APPLICATIONS OF ELECTRICITY

General Aims

The student should develop increased understanding of the basic electrical concepts and develop abilities to perform simple maintenance and trouble-shooting techniques.

MODULE 9.01 FUNDAMENTALS OF ELECTRICITY

Goal Statements

The learning experiences in this module are designed to:

a. develop student understanding of basic electrical theory;
b. clarify the relationship between magnetism and electricity; and
c. develop student ability to connect and read test instruments as voltmeter, ammeter and ohmeter.

Learning Outcomes	Student Activities
The student should be able to: 9.01.01 comprehend the meaning of the following electrical fundamentals: a. characteristics of electricity b. behaviour of like and unlike charges c. relationship between electricity and magnetism d. theory of magnetic flow e. behaviour of like poles and unlike poles f. use of the left hand rule g. Ohm's law h. variations of Ohm's law i. conductors j. insulators k. semi-conductors l. types of circuits m. flow of electrical current n. voltage o. resistance	-refer to assigned reference material and written materials

9.01.02 provide a written definition of electricity	-study the relationship between magnetism and electricity, use a hand compass, a coil of wire, an iron core and a dry cell. Two of these can be used to show attraction and repulsion. (check for rules as they apply to the electron theory)
9.01.03 provide a written definition of magnetism	
9.01.04 calculate (using Ohm's law) simple problems with relationship to direct current flow, voltage and resistance in both series and parallel circuits	-conduct assigned tasks
9.01.05 compile a list of insulators, conductors and semi-conductors that are used on motor vehicles and explain why these materials must be used in specific applications	-prepare a list with an explanation of materials and their applications for discussion with class
9.01.06 use correct procedures to connect voltmeter, ammeter and ohmeter	-place voltmeter in parallel across battery and record reading -place ammeter in series with the battery and operate park lights, record reading, operate headlights, record reading -set ohmeter scale to X 1000 and adjust to zero. Test T.V.R.S. spark plug wire, compare test result with recommended specification

MODULE 9.02 FUNDAMENTALS OF LEAD ACID BATTERY OPERATION

Goal Statements

The learning experiences in this module are designed to:

a. provide the student with a knowledge of the basic operation of the lead acid battery, variation in design and application; and
b. improve student awareness of the reasons for battery failures.

Learning Outcomes	Student Activities
The student should be able to: 9.02.01 demonstrate a working knowledge of the fundamental operating principles of batteries	-using prepared material review fundamentals of batteries
9.02.02 list and explain the methods used to classify batteries	-list classifications in general uses -study reference materials
9.02.03 outline and explain the reasons for battery failure: i.e. a. cycling b. sulphation c. low electrolyte level d. contamination e. plate distoration	

MODULE 9.03 INSPECT, TEST AND SERVICE BATTERIES

Goal Statements

The learning experiences in this module are designed to:

a. emphasize safe handling of batteries;
b. assist the student to inspect a battery visually, observe its condition and make the necessary corrections;
c. have the student test the condition of the battery to determine its capacity;
d. develop the ability to connect a booster battery to a vehicle properly observing safety precautions; and
e. develop the ability to connect either a slow charger or a fast charger to a battery observing safety precautions.

Learning Outcomes	Student Activities
The student should be able to:	
9.03.01	
inspect electrolyte level, exterior condition and cable connections and perform minor repairs to a battery according to manufacturer's specifications	-inspect battery -check electrolyte level and refill if needed -clean battery terminals with wire brush -check cable connections and tighten if needed -apply baking soda solution to clean battery
9.03.02	
use a hydrometer to test an open cell battery and calculate readings at a given temperature	-refer to battery hydrometer test procedure
9.03.03	
use load tester and/or three-minute charge test on any open cell or maintenance free battery and state condition of battery	-refer to instrument test procedure

9.03.04 demonstrate how to connect a booster battery between two vehicles correctly	-refer to procedure sheet and observe safety precautions
9.03.05 distinguish between fast charging, slow charging and trickle charging requirements and methods	-refer to equipment manual and course text book
9.03.06 demonstrate how to connect a slow charger to: a. one battery b. two or more batteries	-use equipment procedure outline and observe listed safety precautions -clarify safety procedures
9.03.07 demonstrate how to connect a fast charger to a vehicle battery	-use equipment manual or service manual for correct procedure to follow and charge rate limits on battery - observe listed safety procedures -clarify safety procedures

MODULE 9.04 INTERPRET BASIC ELECTRICAL SCHEMATICS

Goal Statement

The learning experiences in this module are designed to develop student abilities to read automotive electrical schematic diagrams from workshop manuals.

Learning Outcomes	Student Activities
The student should be able to:	
9.04.01	
draw a schematic diagram of an ignition system	-follow workshop manual for directions -use prepared schematic diagrams
9.04.02	
list essential electrical components and their schematic equivalents	-use prepared schematic diagrams

MODULE 9.05 INSPECT, TEST AND SERVICE SIMPLE CHASSIS CIRCUITS

Goal Statements

The learning experiences in this module are designed to:

a. introduce the student to methods used to check for malfunctioning chassis electrical circuits; and
b. introduce the student to processes for inspecting a chassis lighting circuit for poor grounds.

Learning Outcomes	Student Activities
The student should be able to:	
9.05.01	
describe and demonstrate how a 12v test light is used in checking a basic chassis lighting circuit	-practice checking chassis lighting circuits using a 12v test light to determine electrical circuit conductivity
9.05.02	
describe the importance of the ground circuit to the function of the overall chassis electrical circuit	-identify where the initial ground for a basic headlight circuit begins

UNIT 10.0 WHEELS, HUBS AND TIRES

General Aim

The student should develop skills in dealing with the various applications and combinations of wheels, hubs and tires and the ability to diagnose and service these combinations.

MODULE 10.01 CONSTRUCTION AND DESIGN FEATURES OF TIRES

Goal Statements

The learning experiences in this module are designed to acquaint the student with the design, construction, purpose and applications of tires.

Learning Outcomes	Student Activities
The student should be able to:	
10.01.01 describe the functions of a tire	-discuss the purpose and function of a tire
10.01.02 identify light duty tire designs, construction and materials	-read the tire design construction characteristics and materials from the tire markings

MODULE 10.02 TYPES AND APPLICATIONS OF WHEEL BEARINGS

Goal Statements

The learning experiences in this module are designed to acquaint the student with the various types of wheel bearings commonly used in the mechanical trades.

Learning Outcomes	Student Activities
The student should be able to:	
10.02.01	
recognize the various types of wheel bearings in general use	-discuss importance of wheel bearings
10.02.02	
list various types of wheel bearings in general use	-study assigned information on wheel bearings

MODULE 10.03 WHEEL AND HUB SERVICE PROCEDURES

Goal Statements

The learning experiences in this module are designed to:

a. acquaint the student with the need for tire, wheel and hub maintenance; and
b. develop the ability to diagnose problems, analyze failures, and service tire, wheel and hub assemblies.

Learning Outcomes	Student Activities
The student should be able to:	
10.03.01	
outline the procedure for balancing tire, wheel and hub assembly	-discuss procedures for balancing tire, wheel and hub assembly
10.03.02	
identify the wheel bearing type; disassemble, clean, inspect, pack and install to the manufacturer's specifications on a light service vehicle	-disassemble, clean, inspect, pack and install the wheel bearings to manufacturer's specifications
10.03.03	
identify and report on common wheel bearing failures	-review common wheel bearing failures from samples or a chart

UNIT 11.0 HYDRAULIC SYSTEMS

General Aims

The student should:

a. develop the ability to recognize the advantages and disadvantages of transmitting power by hydraulics as well as the general applications of hydraulics to the mechanical trades,
b. learn to interpret basic hydraulic schematics, and
c. recognize the need for basic maintenance and servicing of hydraulic systems.

MODULE 11.01 HYDRAULIC PRINCIPLES

Goal Statement

The learning experiences in this module are designed to:

a. help the student to understand and use Pascal's law,
b. assist the student in understanding the advantages and disadvantages of transmitting power by hydraulics, and
c. increase student awareness of components utilized in hydraulic systems.

Learning Outcomes	Student Activities
The student should be able to:	
11.01.01	
list common advantages and disadvantages of transmitting power by hydraulics	-discuss advantages and disadvantages of transmitting power by hydraulics
11.01.02	
describe the relationship between pressure, force and area	- given required values calculate to within 2 decimal places kPa, force or area using Pascal's law. Complete the above calculations in S.I. metric

11.01.03 demonstrate the use of the following formulae: work = force X distance area of circle = πR^2 $= \frac{\pi}{4} D^2$ volume cylinder = πR^2 X L force = pressure X area	
11.01.04 define the purpose of the following components: a. reservoirs and filters b. pumps and motors c. accumulators and heat exchangers d. cylinders and seals e. common valves: -pressure control -direction control -flow control	-discuss the applications of these components
11.01.05 describe the advantages and disadvantages of open and closed hydraulic systems	-discuss open and closed hudraulic systems
11.01.06 describe the effects of different line sizes and restrictions on velocity and pressure in a basic hydraulic system	-discuss the effect of different line sizes and restrictions on velocity and pressure in a basic hydraulic system

MODULE 11.02 HYDRAULIC SAFETY PRACTICES

Goal Statements

The learning experiences in this module are designed to:

a. increase the student awareness of recommended safety procedures and practices as applied to basic hydraulic systems; and
b. develop the student awareness of the need to follow manufacturers' directions on specific equipment before any repairs, inspection or service is carried out.

Learning Outcomes	Student Activities
The student should be able to:	
11.02.01 describe safety procedures as they relate to working on basic hydraulic circuits	-discuss related safety procedures
11.02.01 outline the safety procedures to follow by referring to a manufacturer's service manual of given directions	-refer to various manufacturers' service manuals

MODULE 11.03 TEST, INSPECT AND SERVICE BASIC HYDRAULIC COMPONENTS

Goal Statements

The learning experiences in this module are designed to:

a. assist the student to test and inspect basic hydraulic systems;
b. assist the student to test and inspect basic hydraulic components; and
c. increase student awareness of the need for preventative maintenance and servicing of hydraulic systems.

Learning Outcomes	Student Activities
The student should be able to:	
11.03.01 perform a pressure test on a basic hydraulic system	-discuss in a group, locations for testing pressure in a basic hydraulic system
11.03.02 inspect components as to serviceability in a basic hydraulic system	-discuss serviceability of components in a basic hydraulic system
11.03.03 explain the need for regular servicing of a hydraulic system	

UNIT 12.0 BRAKE SYSTEMS

General Aims

The student should:

a. gain experience with various types of vehicle and equipment braking systems, and
b. develop skills in diagnosing and servicing hydraulic brake systems to manufacturers' specifications.

MODULE 12.01 FUNDAMENTALS OF AUTOMOTIVE BRAKES

Goal Statements

The learning experiences in this module are designed to:

a. develop a critical awareness of the importance of safety connected with brake system service;
b. develop increased awareness of the physical properties of brakes; and
c. develop abilities to diagnose hydraulic brake system problems.

Learning Outcomes	Student Activities
The student should be able to:	
12.01.01 demonstrate a working knowledge of the fundamental principles of brake systems	-discuss the factors of friction and the various types -study assigned materials
12.01.02 define Pascal's law	-discuss pressure, force and area
12.01.03 explain and outline the correlation between brake temperature and braking efficiency	-discuss brake fade

12.01.04 describe the design and explain the purpose and operation of a standard hydraulic system and basic drum brake unit	-discuss drum hydraulic brake system components
12.01.05 describe the design and explain the function and application of the major components of: a. hydraulic system b. master cylinders c. wheel cylinders d. brake shoes e. drums f. self-adjusting mechanisms g. hand brakes and cables	-study assigned materials

MODULE 12.02 INSPECT AND SERVICE HYDRAULIC AND MECHANICAL BRAKE SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. develop student abilities to inspect and service hydraulic brake systems,
b. develop a logical and sequential order of disassembly inspection and assembly of hydraulic brake systems, and
c. develop student awareness of the need to recondition components within manufacturer's specifications.

Learning Outcomes	Student Activities
The student should be able to: 12.02.01 identify by name, components subject to wear 12.02.02 perform drum turning 12.02.03 overhaul master cylinders 12.02.04 overhaul wheel cylinders 12.02.05 test, bleed and adjust brake systems 12.02.06 adjust parking brakes (cable type)	Note: For this module utilize small group activities to dismantle, inspect, service and assemble brake system components: a. master cylinder b. drum assembly c. brake linings d. wheel cylinders

MODULE 12.03 OPERATION OF DISC BRAKES

Goal Statement

The learning experiences in this module are designed to develop an understanding of the operation of disc brake systems.

Learning Outcomes	Student Activities
The student should be able to:	
12.03.01	
demonstrate a working knowledge of the principles of disc brake operation	-discuss the principles of disc brake operation
12.03.02	
demonstrate a working knowledge of the principles of operation of the following valves: a. metering b. proportioning c. pressure differential	-explain the purpose and operation of metering valves, proportioning valves and pressure differential valves
12.03.03	
diagnose common disc brake system malfunctions	-list common disc brake system malfunctions

MODULE 12.04 SERVICING DISC BRAKE SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. develop student abilities to inspect and service disk brake systems;
b. assist the student to develop a logical and sequential order of disassembly inspection and assembly of disc brake systems; and
c. increase student awareness of the need to recondition components within manufacturer s' specifications.

Learning Outcomes	Student Activities
The student should be able to: 12.04.01 identify by name components subject to wear 12.04.02 perform rotor turning observing established safety procedures 12.04.03 overhaul a disc brake master cylinder 12.04.04 overhaul a caliper assembly 12.04.05 test, bleed and adjust a disc brake system	Note: For this module, utilize small group activities to dismantle, inspect, service and assemble: a. disc brake components b. master cylinders c. rotor assembly d. caliper assembly

UNIT 13.0 BASIC INTERNAL COMBUSTION GASOLINE ENGINES - DESIGN AND OPERATION

General Aims

The student should learn the fundamentals of, and engage in shop activities related to the application and operation of two stroke cycle and four stroke cycle engines.

MODULE 13.01 THEORY AND DESIGN OF TWO AND FOUR STROKE CYCLE DESIGNS

Goal Statement

The learning experiences in this module are designed to increase student awareness of the theories of both two stroke and four stroke engines, including the advantages and/or disadvantages of each.

Learning Outcomes	Student Activities
The student should be able to:	
13.01.01	
identify and explain the power transfer and components from piston to power take off	-discuss and observe the movement of the piston, connecting rod and crankshaft of a four/two stroke cycle engine
13.01.02	
write a single paragraph explaining the meaning of each of the following: a. top dead centre b. bottom dead centre c. stroke d. bore e. throw	-rotate the crankshaft -discuss and observe top dead centre, bottom dead centre

13.01.03	
identify the valve and timing components and explain their operation as part of the four stroke cycle theory	-discuss and observe the relationship between piston movement, valve movement, intake and exhaust
13.01.04	
define clearance volume, stroke volume, total volume, compression ratio and volumetric efficiency	-study and discuss the derivation and use of the formulae involved
13.01.05	
illustrate and discuss the meaning of "square" and "over-square" engine design	-study and discuss the meaning of "square" and "oversquare" as it applies to the group engine
13.01.06	
define and calculate power for a given engine	-discuss, study and calculate as it applies to the group engine
13.01.07	
outline the difference between the theories of operation of a two stroke and four stroke engine	-study and discuss the piston movement in relation to the intake, compression power and exhaust functions

13.01.08	
explain alternate camshaft positions and their advantages and/or disadvantages	-locate position of camshaft -study and discuss alternate positions and why they might be so located
13.01.09	
explain how engines may be classified by their valve arrangements	-notice the position of the intake and exhaust valves -study and discuss alternate positions and the advantages and/or disadvantages of the positions
13.01.10	
trace the timing system from the piston movement to the corresponding valve position; state the purpose and function of the cam lobes	-locate the timing mechanism which connect the crankshaft and the camshaft -find the timing marks which assure the correct alignment of the gear teeth -count the number of teeth on each gear and calculate how often the crankshaft rotates for each revolution of the camshaft -remove camshaft -study and discuss
13.01.11	
identify and compare various types of lubrication systems	-study and discuss oil dippers, slingers and pumps as used on small four stroke engines -identify the type used on your engine
13.01.12	
state the functions of a lubricating system, how it is maintained and explain the specifications of the lubricants involved	-study and discuss lubricants, systems and filters

13.01.13 describe the components of both manual and electrical cranking systems and their operation	-remove rope pulley unit from engine -study and discuss its assembly and operation -study and discuss an alternate electrical application
13.01.14 repair and service both types of cranking systems	-carry out disassembly and assembly of both types of cranking units
13.01.15 describe and compare air and liquid cooling systems	-remove the flywheel blower housing -study and discuss the principles and operation of both air and liquid cooling systems (include all auxiliary parts such as fins, deflectors, hoses, thermostats, etc.)
13.01.16 explain the purpose and operation of the crankcase ventilating system; describe the treatment of crankcase ventilation to lessen atmospheric pollution	-locate and remove the valve spring cover which contains the crankcase ventilation unit -study and discuss the principles and operation involved including pollution control
13.01.17 draw and explain diagram of the ignition system	-remove flywheel according to the engine manual -remove ignition cover -study and discuss the ignition system

13.01.18 identify various engine bearings and journals; explain their individual applications	-remove connecting rod and piston assembly -remove crankshaft -study and discuss the actual and possible types of bearings involved
13.01.19 describe the alternate methods of measuring bearings and journals; carry out accurate measurements of bearings and journals	-study, discuss and carry out bearing and journal measurements
13.01.20 describe the functions of an exhaust system; state two reasons for the use of a muffler	-study and discuss exhaust systems -remove muffler from the engine -check with instructor to determine if the muffler on your engine is removable or the new disposable type
13.01.21 outline the operation of a simple carburetor, including the theory of the venturi	-study and discuss the theories of carburetion -remove the carburetor and relate essential information to it
13.01.22 explain the principles of governors and their application to fuel flow control	-study, observe and discuss the air-vane (pneumatic) governor on your engine -remove governor and study its construction, design and linkage

13.01.23	
illustrate and/or outline valve keepers, valve spring tension, valve stretch, valve burning, valve "float", valve margin and interference angle, valve seats and inserts, valve grinding	-consult engine manual and then remove the exhaust and intake valves using the special tools and techniques required -study and discuss valve theory and design
13.01.24	
outline the difference between the theories of operation of a two stroke cycle and four stroke cycle engine	-disassemble a two stroke cycle engine to the point that the crankcase cover (bearing plate) is removed -study and discuss the piston movement in relation to the intake, compression power and exhaust functions
13.01.25	
trace the process and explain how the fuel is drawn into the crankcase and then forced up into the cylinder	-study and discuss the use of reed valves and piston action to control the one-way flow of fuel into the crankcase -notice how the pressure in the crankcase would drive the fuel up into the combustion chamber
13.01.26	
explain how the intake and exhaust ports are opened and closed	-rotate the crankshaft and note the effect of the piston movement on the ports
13.01.27	
describe why some piston heads are contoured on a two stroke cycle engine	-remove the crankshaft and piston assembly from engine block -study and discuss the shape of the piston head

13.01.28	
state alternate piston head designs and the reasons for their shapes in other types of engines	-study and discuss alternate piston head contours
13.01.29	
explain the lubrication system of a two stroke cycle engine	-study and discuss the lubrication system of a two-stroke cycle engine
13.01.30	
explain the advantages and disadvantages of both types of small engines; list applications for these engines and the reasons for choosing one or the other	-analyze engine applications and discuss the reason for them
13.01.31	
diagnose typical small engine problems and carry out the appropriate remedy	-study and discuss the systematic routine for diagnosing fuel and electrical problems, etc. -make necessary adjustments to correct malfunctions
13.01.32	
carry out regular tune-up, reconditioning and maintenance of small engines	-consult engine manual -study and discuss engine maintenance
13.01.33	
locate information from a search of texts and engine manuals for correct data, procedure, torque, and specifications for typical engine makes and models	-study and discuss the use of tables and charts as used on small engines
13.01.34	
identify each part of the small engine by name and state the system each part belongs to	-assemble the engine in the correct order, using all the correct torques, special tools, and recommended adjustments

UNIT 14.0 ENGINES - GASOLINE (MULTI-CYLINDER)

General Aim

The student should gain increased understanding of the design, construction and operation of multi-cylinder gasoline engines and develop the ability to evaluate engine components.

MODULE 14.01 DESIGN, CONSTRUCTION AND OPERATION OF MULTI-CYLINDER INTERNAL COMBUSTION ENGINES

Goal Statements

The learning experiences in this module are designed to:

a. increase student awareness of the design, construction and operation of multi-cylinder internal combustion engines;
b. increase student awareness of the differences between small gasoline engines, diesel, and multi-cylinder gasoline engines; and
c. provide experiences with the construction and operation of multi-cylinder internal combustion engines.

Learning Outcomes	Student Activities
The student should be able to:	
14.01.01	
list the major differences between single and multi-cylinder gasoline engines	-discuss the major difference between single and multi-cylinder gasoline engines
14.01.02	
state the various classifications of multi-cylinder engines	-discuss and list the various classifications of multi-cylinder engines
14.01.03	
outline design features and considerations for combustion chambers, valve trains and related internal combustion engine components	-discuss design features and considerations for combustion chambers, valve trains and related internal combustion engine components

MODULE 14.02 INSPECT, MEASURE AND EVALUATE ENGINE PARTS

Goal Statements

The learning experiences in this module are designed to:

a. develop student ability to inspect and evaluate engine components;
b. develop skills required to measure engine components; and
c. assist the student in the evaluation of engine components for service, wear or replacement.

Learning Outcomes	Student Activities
The student should be able to:	
14.02.01	
identify engine components subject to wear	-discuss engine components subject to wear
14.02.02	
evaluate engine components by visual inspection	-as a group activity, disassemble an internal combustion gasoline engine and evaluate components by visual inspection
14.02.03	
evaluate engine components with precision measuring equipment and refer to a manufacturer's specification manual	-use precision measuring equipment and manufacturer's specification manual to evaluate engine components
14.02.04	
identify engine components requiring replacement	-discuss replacement of components that do not meet manufacturers' specifications

UNIT 15.0 DIESEL ENGINES

General Aims

The student should develop an awareness of the characteristics and operation of the modern diesel engine.

MODULE 15.01 BASIC OPERATION OF THE DIESEL ENGINE

Goal Statements

The learning experiences in this module are designed to:

a. increase student understanding of the principle of the ignition and combustion of fuel from the heat generated by the compression of air in the diesel engine combustion space; and
b. develop a working knowledge of how compression ratio for a cylinder is calculated.

Learning Outcomes	Student Activities
The student should be able to:	
15.01.01 recognize and describe the process that causes air to become heated when rapidly compressed	-using proper apparatus, compress air and note temperature rise
15.01.02 compare compression pressure readings on a gasoline engine and readings on a diesel engine	-develop readings and apply to the formula: $CR = \frac{D + C}{C}$
15.01.03 state reasons why a diesel engine must be constructed so as to withstand the greater forces involved	-prepare an essay to explain compression ignition in diesel engines
15.01.04 discuss general cyclic operation of diesel engines	-discuss the cyclic operation and discussion of two stroke cycle and four stroke cycle diesel engine

MODULE 15.02 DIESEL ENGINE APPLICATIONS

Goal Statements

The learning experiences in this module are designed to:

a. develop student awareness of the differences there would have to be in any one particular engine if it were to be installed as a marine engine, an industrial engine or a truck installation; and
b. provide increased understanding of the various ways that water is used to keep engines at the proper operating temperatures, depending upon their application and installation.

Learning Outcomes	Student Activities
The student should be able to: 15.02.01 differentiate between a marine and truck diesel application in respect to cooling 15.02.02 demonstrate how marine cooling components and radiators are used in cooling systems	-class will form into four groups - each taking a particular engine installation and show by overhead transparencies how a marine heat exchanger works, how a keel cooler works, how a radiator works and how an oil cooler works

MODULE 15.03 DESIGN CLASSIFICATION OF DIESEL ENGINES

Goal Statement

The learning experiences in this module are designed to develop student knowledge of the various design classifications of diesel engines.

Learning Outcomes	Student Activities
The student should be able to: 15.03.01 indicate and outline the differences in particular design characteristics	Note: small group activity -each group should select two classifications and use appropriate resources to present a short program

MODULE 15.04 OUTLINE OF DIESEL ENGINE COMBUSTION CHAMBERS

Goal Statement

The learning experiences in this module are designed to introduce the student to the various configurations of combustion chambers and the particular manufacturers that employ them.

Learning Outcomes	Student Activities
The student should be able to: 15.04.01 recognize and describe the following combustion chambers and in what particular engines they are utilized: a. open type combustion chamber b. pre-combustion chamber c. turbulence chambers	-study and discuss the various combustion chamber designs, advantages and disadvantages -construct a line drawing of each chamber and a short description of its operation

MODULE 15.05 DIESEL ENGINE AIR INDUCTION COMPONENTS

Goal Statement

The learning experiences in this module are designed to introduce the student to the function of the various components of the air induction systems as applied to diesel engines.

Learning Outcomes	Student Activities
The student should be able to:	
15.05.01 recognize and describe the various types of air cleaners and the importance of clean air	-disassemble various types of air cleaners
15.05.02 describe the operation and function of a turbocharger and how this will differ in construction and purpose from a mechanical roots type blower (G.M.)	-view and study cutaway of a typical turbocharger (if available)
15.05.03 explain the purpose and location of an after cooler located in the air induction system	
15.05.04 outline the reasons for turbocharging and why naturally aspirated engines lose power with increases in altitude	

UNIT 16.0 FUEL DELIVERY SYSTEMS

General Aim

The student should develop a basic concept of the chemistry of combustion and the various methods of fuel delivery and supply.

MODULE 16.01 CHEMISTRY OF COMBUSTION

Goal Statements

The learning experiences in this module are designed to:

a. increase student understanding of the composition of air and fossil fuels; and
b. develop awareness of the details in the chemistry of the combustion process and the formation of the various pollutants.

Learning Outcomes	Student Activities
The student should be able to:	
16.01.01 demonstrate a working knowledge of the fundamentals of fuels	-discuss the fundamentals of fuel
16.01.02 demonstrate a working knowledge of engine fuels	-discuss engine fuels
16.01.03 explain: a. combustion process (diesel and gasoline) b. heat c. change of state d. expansion of solids, liquids and gases due to heat e. penetration (diesel)	-discuss a. combustion process (diesel and gasoline) b. heat c. change of state d. expansion of solids, liquids and gases due to heat e. penetration (diesel)

16.01.04 explain the increase of pressure due to: a. temperature b. gravity c. atmospheric pressure and vacuum	-study assigned materials and discuss in class
16.01.05 outline the characteristics of gasoline: a. its origin b. volatility c. anti knock value d. octane ratings	-study assigned materials and discuss in class
16.01.06 state the cause of: a. knocking b. compression ratio versus knocking c. detonation d. pre-ignition	-study assigned materials and discuss in class
16.01.07 explain the causes and effects of the following exhaust emissions: a. hydrocarbon (HC) b. carbon monoxide (CO) c. oxides of nitrogen (NO_x)	-study assigned materials and discuss in class

MODULE 16.02 PRINCIPLES OF CARBURETION

Goal Statements

The learning experiences in this module are designed to:

a. increase student understanding of the principles of carburetion;
b. develop student ability to diagnose carburetor problems; and
c. increase student ability to interpret manufacturers' recommended service and adjustment procedures.

Learning Outcomes	Student Activities
The student should be able to:	
16.02.01 demonstrate a working knowledge of the principles of carburetion	-discuss the principles of carburetion
16.02.02 identify the six carburetor circuits in a single barrel carburetor	-small groups to disassemble, inspect, adjust and assemble a single barrel carburetor that contains all six circuits
16.02.03 explain the operation of the six circuits in a single barrel carburetor	
16.02.04 adjust the idle mixture and idle speed on a single barrel carburetor	
16.02.05 adjust the float level and drop in a single barrel carburetor	
16.02.06 interpret and outline a description of: a. Bernouilli's Principle b. Boyle's Law c. Charles' Law	-discuss the following: a. Bernouilli's Principle b. Boyle's Law c. Charles' Law

MODULE 16.03 FUEL PUMPS, TANKS, LINES AND FILTERS

Goal Statements

The learning experiences in this module are designed to:

a. develop a working knowledge of gasoline fuel system operation and principles;
b. develop student ability to diagnose fuel system problems on gasoline engine equipped vehicles; and
c. develop an awareness of the need for preventative maintenance as set out by the manufacturer's service manuals.

Learning Outcomes	Student Activities
The student should be able to:	
16.03.01 describe the construction and operating principles of mechanical fuel pumps	-discuss the construction and operating principles of mechanical fuel pumps
16.03.02 perform tests on mechanical fuel pumps with the prescribed equipment	-in small groups, perform the following mechanical fuel pump tests: a. pressure b. vacuum c. volume
16.03.03 describe the operating principles and construction of electrical fuel pumps	-discuss operating principles and construction of electrical fuel pumps
16.03.04 perform tests on electrical fuel pumps with the prescribed equipment	-in small groups, perform the following tests on electrical fuel pumps a. pressure b. vacuum c. volume

16.03.05 analyze a fuel pump condition by using obtained test data and referring to a manufacturer's service manual	-interpret fuel pump condition by using given data and comparing it to manufacturers' specifications
16.03.06 describe the design and explain the purpose and application of the: a. fuel tank b. fuel filters and screens c. fuel gauges d. air cleaners e. intake manifolds	-discuss the construction, design and operating principles
16.03.07 describe preventative maintenance (refer to a manufacturer's service manual)	-refer to manufacturers' service manuals for preventative maintenance and service procedures on fuel supply systems

UNIT 17.0 COOLING SYSTEMS

General Aim

The student should gain experience in the operational theory and functional service procedures leading to abilities to diagnose and service cooling systems.

MODULE 17.01 PRINCIPLES OF OPERATION AND TYPES OF SYSTEMS

Goal Statement

The learning experiences in this module are designed to help the student be conversant with the principles of cooling and the characteristics of the various types of systems.

Learning Outcomes	Student Activities
The student should be able to: 17.01.01 define conduction, convection and radiation 17.01.02 describe the forced circulation system 17.01.03 explain the purpose and advantages of the sealed and closed type of system and their respective coolant recovery methods 17.01.04 outline the difference between liquid and air-cooling systems	-review using classroom and textbook information

MODULE 17.02 RADIATORS AND AUXILIARY COOLING SYSTEMS AND COMPONENTS

Goal Statement

The learning experiences in this module are designed to provide the student with experiences to test, service, replace and diagnose cooling system components according to manufacturers' service recommendations.

Learning Outcomes	Student Activities
The student should be able to:	
17.02.01	
demonstrate a working knowledge of the fundamental operating principles of cooling systems	-review classroom and textbook information
17.02.02	
explain the construction of cross and downflow type of radiators and transmission coolers	-review using classroom and textbook information
17.02.03	
discuss and list the characteristics of antifreeze solutions and their mixing ratios	-review using classroom and textbook information
17.02.04	
describe the function of radiators, pressure caps, thermostats, cooling fan mechanisms and their respective testing procedures	-list and describe for discussion
17.02.05	
diagnose common cooling system failures	-use prepared list of common problems and trouble-shooting procedures

17.02.06 demonstrate how to service and test cooling systems with the prescribed equipment	-follow a service manual procedure ; use a pressure tester and anti-freeze tester -observe established safety procedures

UNIT 18.0 LUBRICATING SYSTEMS

General Aim

The student should develop a working knowledge of the different oils, greases, lubrication systems, and maintenance methods required in the mechanical field.

MODULE 18.01 TWO STROKE CYCLE AND FOUR STROKE CYCLE LUBRICATION METHODS

Goal Statement

The learning experiences in this module are designed to develop understanding of the two and four stroke cycle oil delivery systems and the functions of pressure pumps and oil filter systems.

Learning Outcomes	Student Activities
The student should be able to:	
18.01.01	
demonstrate a working knowledge of the fundamental operating principles of two and four stroke cycle lubricating systems	-review information from class discussions, compare and contrast the two systems
18.01.02	
identify types of pressure pumps used in engine lubricating systems	-review classroom and textbook information on gear and rotor type pumps
18.01.03	
explain the differences between full flow and combination systems	-discuss in class
18.01.04	
list and categorize filter systems and types of elements in common use	-study assigned materials and discuss in class

MODULE 18.02 INSPECT AND SERVICE LUBRICATING SYSTEMS AND COMPONENTS

Goal Statements

The learning experiences in this module are designed to:

a. increase student understanding of the essential characteristics of oils and greases; and
b. orient the student to correct procedures for inspection and service of motor vehicle lubrication systems.

Learning Outcomes	Student Activities
The student should be able to:	
18.02.01	
identify compatable vehicle lubricants and state why different types of lubricants are used	-study and discuss various lubricants, their characteristics and their application
18.02.02	
prepare a list of the functions of different lubricants, engine, transmission (standard and automatic), final drive	-refer to assigned references
18.02.03	
select a specific type of lubricant for a given engine and its particular operating conditions; explain why this lubricant is desirable	-base a decision on manufacturer's information, age of vehicle, S.A.E., viscosity ratings and A.P.I. service ratings
18.02.04	
demonstrate methods of changing the oil and filter; run engine at job completion to check for leaks	-refer to vehicle manufacturer's specifications, use correct filter replacement
18.02.05	
demonstrate methods of cleaning or replacing breathers, filters, positive crankcase ventilation valves	-refer to vehicle manufacturer's specifications

18.02.06 demonstrate how to lubricate chassis and complete a checklist of important vehicle maintenance factors	-use the prepared outline for chassis lubrication and vehicle maintenance checks

UNIT 19.0 CLUTCHES

General Aim

The student should gain experiences in dealing with the theory and operation of motor vehicle clutches.

MODULE 19.01 FUNDAMENTALS OF CLUTCH OPERATION

Goal Statement

The learning experiences in this module are designed to develop student ability to test, diagnose, service and replace clutch assemblies and related components to manufacturers' service recommendations.

Learning Outcomes	Student Activities
The student should be able to:	
19.01.01 outline the construction and operating principles of clutch assemblies	-use classroom charts and classroom notes to clarify operation of motor vehicle
19.01.02 state the operation of hydraulically activated clutch mechanisms	
19.01.03 diagnose common clutch and assembly malfunctions	
19.01.04 prepare a list of common problems relating to clutch failures and precautions that should be observed when removing and installing a clutch	

19.01.05 remove and install clutch assemblies with the prescribed service tools	-as a group activity under the direction of the instructor, remove and replace a clutch using proper hand and alignment tools
19.01.06 state the significance of correct clutch pedal free play adjustment	
19.01.07 make correct adjustment to a motor vehicle clutch	

UNIT 20.0 TRANSMISSION

General Aims

The student should develop a working knowledge of:

a. the basic terminology and operation of standard transmissions, and
b. the diagnostic decisions and repair procedures relating to standard transmissions.

MODULE 20.01 FUNDAMENTALS OF STANDARD TRANSMISSION OPERATION

Goal Statements

The learning experiences in this module are designed to:

a. increase student awareness of the terminology used in standard transmission theory, diagnosis and repair;
b. provide a basic understanding of gear ratio, torque, and power flow in the standard transmission;
c. assist the student to use correct methods for servicing and selecting lubricants for standard transmissions; and
d. develop student understanding of four and five speed transmissions.

Learning Outcomes	Student Activities
The student should be able to:	
20.01.01	
identify (by correct technical terms) the types of gears, bushings, bearings, shafts and lubricants used in standard transmissions	-study assigned materials and references
20.01.02	
prepare a list of technical terms for the various component pieces in the standard transmission	
20.01.03	
calculate accurately all torque and gear ratios through a standard transmission (using the appropriate formulae)	-work with prepared problems relating to torque and gear ratios in the standard transmission

20.01.04 trace the power flow through the standard transmission	-use the wall charts and cutaway examples to study the power flow in a standard transmission
20.01.05 identify compatible oils accurately and state why different types and weights of lubricants are used	-use a lubricant specification chart to base information on
20.01.06 select a specific type of lubricant for a given standard transmission and state the reason for its use	-study assigned reference material
20.01.07 outline applications for constant mesh, sliding gear, four and five speed transmissions	
20.01.08 list examples of light vehicle uses for the four and five speed transmissions	-prepare for a discussion of the advantages and disadvantages of these transmissions and applications

MODULE 20.02 MAINTENANCE AND REPAIR OF THE STANDARD TRANSMISSION

Goal Statements

The learning experiences in this module are designed to:

a. develop the student ability to diagnose simple problems in standard transmissions, and
b. to help the student apply correct procedures to inspect and repair standard transmissions.

Learning Outcomes	Student Activities
The student should be able to:	
20.02.01	
describe the methods used to isolate malfunctions related to standard transmissions, such as excessive heat, excessive noise, vibrations, slipping out of gear under coast or load conditions and hard shifting	-follow manufacturer s' service manual trouble-shooting guide and list problems and causes
20.02.02	
disassemble one single counter-shaft standard transmission demonstrating the procedures used for the removal of gears, bearings, bushings, seals, shafts and synchronizers	-in small groups, disassemble a standard transmission
20.02.03	
identify transmission parts requiring replacement from the previously disassembled transmission	-compare parts provided in shop
20.02.04	
prepare a list of common faults to be found in transmission parts using the prescribed text and classroom information	

20.02.05 write a clear and concise report on the work and/or parts required	-refer to material on report writing

UNIT 21.0 INTRODUCTION TO DRIVESHAFTS AND DRIVELINES

General Aim

The student should gain experiences with the function and operation of types of driveshafts and drivelines utilized in light service vehicles.

MODULE 21.01 FUNCTION AND OPERATION OF DRIVESHAFTS AND DRIVELINES

Goal Statements

The learning experiences in this module are designed to:

a. develop awareness of the need for various types of driveshafts and drivelines;
b. develop understanding of driveshaft construction;
c. develop understanding of the function and operation of driveshaft and driveline components;
d. increase student awareness of the need to perform preventive maintenance service.

Learning Outcomes	Student Activities
The student should be able to:	
21.01.01	
outline the need for various types of driveshafts and drivelines	-group discussion of the need for various types of driveshafts
21.01.02	
state the various types of driveshaft construction	-discuss and list various types of driveshaft construction

21.01.03	
outline the function and operation of the driveshaft and driveline components: a. driveshafts b. universal joints c. slip joints d. splines e. steady bearings f. companion flanges and yokes	-discuss and list the operation of the driveshaft components -discuss the function and operation of the following driveline components: a. driveshafts b. universal joints c. slip joints d. splines e. steady bearings f. companion flanges and yokes
21.01.04	
list reasons for preventative maintenance	-discuss the need for preventative maintenance

UNIT 22.0 FINAL DRIVE

General Aim

The student should develop increased understanding and awareness of final drive types, operations and inspections as related to light service vehicles.

MODULE 22.01 DIFFERENTIALS - TYPES AND OPERATION

Goal Statement

The learning experiences in this module are designed to help the student understand the types and operation of final drives as utilized in light service vehicles.

Learning Outcomes	Student Activities
The student should be able to:	
22.01.01 state the basic differences between types of final drives	
22.01.02 demonstrate a working knowledge of the fundamental operating principles of both hypoid gear and spur bevel gear differentials as used in light service vehicles	-discuss theory of operation and power flow through a hypoid gear or spur bevel gear differential, using wall charts or classroom models

MODULE 22.02 INSPECTION OF DIFFERENTIALS

Goal Statement

The learning experiences in this module are designed to develop student ability to inspect final drive assemblies and components for serviceability, referring to manufacturers' repair manuals.

Learning Outcomes	Student Activities
The student should be able to: 22.02.01 list common differential problems and causes of failure 22.02.02 diagnose component failure by reference to a manufacturer's repair manual	

UNIT 23.0 STEERING SYSTEMS, SUSPENSION AND FRAME DESIGNS

General Aim

The student should gain a general knowledge of the geometry of front end alignment and the methods used to identify types of front suspension systems.

MODULE 23.01 TYPES AND IDENTIFICATION OF FRONT SUSPENSION SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. provide opportunities for each student to recognize the common types of steering systems in use on light vehicles; and
b. develop student understanding of the basic theory of the solid "I" beam suspension and the independent front suspension.

Learning Outcomes	Student Activities
The student should be able to:	
23.01.01	
identify the various front suspension methods starting with the two basic methods	-using a prepared list of front suspension systems, seek out cars with examples of the listed types
23.01.02	
write down the year and make of the vehicle beside its respective suspension system	-study I beam, twin I beam, conventional, coil over, strut type, parallel and lateral type torsion bar suspension

MODULE 23.02 FRONT AND REAR SUSPENSION SPRINGS AND SHOCK ABSORBERS

Goal Statements

The learning experiences in this module are designed to:

a. provide the student with an overview of the characteristics of the various spring types;
b. provide an introduction to the operation of shock absorbers; and
c. increase student ability to identify the various methods of rear suspension.

Learning Outcomes	Student Activities
The student should be able to:	
23.02.01 recognize and identify the various designations of springs	
23.02.02 list four spring types (single or multileaf, coil and torsion bar)	-discuss single or multileaf, coil and torsion bar
23.02.03 state Hooke's Law as it applies to springs	-study elasticity of materials and Hooke's Law
23.02.04 outline reasons for a shock absorber	-refer to notes and classroom discussion on spring oscillation
23.02.05 trace the fluid flow in a direct acting or telescopic-type hydraulic shock absorber	-using a wall chart, trace the fluid flow for a shock absorber in both compression and rebound positions

23.02.06 describe the differences between the solid axle and independent rear suspensions emphasizing the advantages/disadvantages of each	-use classroom notes and prescribed text to study rear suspension systems
23.02.07 outline the reason for a stabilizer bar being installed on a vehicle	-use prescribed text for definition

MODULE 23.03 FRONT SUSPENSION INSPECTION AND FRONT END GEOMETRY

Goal Statements

The learning experiences in this module are designed to:

a. introduce the student to procedures for checking a front end visually for wear;
b. introduce the student to the geometry of the steering system; and
c. orient the student to approved procedures for making adjustments in front end alignment

Learning Outcomes	Student Activities
The student should be able to:	
23.03.01	
identify parts subject to wear on a vehicle steering system	-as a group, using a list of common faults and checking procedures for front suspension, compile a report on a vehicle for the instructor to evaluate (tire wear, shock absorbers, spring condition, ball joint and steering linkage wear, steering gear box wear)
23.03.02	
describe the following terms and state the purpose of each: caster, camber, toe-in, king pin inclination, turning radius, toe-out on turns, included angle	-with handout and notes from classroom lessons and workshop demonstration, prepare definitions and purpose of front end geometric terms
23.03.03	
point out on a model of a front end suspension how to adjust caster and camber	-practice adjusting caster and camber on working model front end -record original setting -make several adjustments and record -return to original settings

MODULE 23.04 FRAME DESIGNS AND CHARACTERISTICS

Goal Statements

The learning experiences in this module are designed to:

a. help student understanding of the advantages and safety features of the integral body and frame construction (unibody) design; and
b. increase student awareness of the differences between the "X"- type frame and box girder frame design.

Learning Outcomes	Student Activities
The student should be able to:	
23.04.01	
state the advantages and safety features of the integral body and frame (unibody) design	-discuss the advantages and safety features of the integral body and frame (unibody) design
23.04.02	
outline the differences between "X"-type frame and box girder frame design	-discuss the differences between the "X"-type frame and box girder frame design

Section Three
CP12 - General Mechanics

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C P 12 - GENERAL MECHANICS

General Aim and Purpose

The primary aim of this general mechanics program in grade 12 is to provide learning experiences that will help students develop marketable skills or qualify for advanced standing in a related program at a college or provincial institute. At the grade 12 level, an integral part of the learning experience involves practical experience in a working situation external to the school. This cooperative career preparation component involves at least 100 hours of activities that are community based to provide actual work experience organized through the cooperation of employers and union organizations.

Students should acquire a comprehensive knowledge of:

a. basic requirements for successful employment in general mechanics vocations;

b. practices for clean, safe and orderly work habits;

c. theory of operation and construction of mechanical vehicles;

d. maintenance, repair and adjustments related to the general mechanics occupations;

e. concepts applicable to trouble-shooting techniques;

f. employment opportunities and occupational qualifications needed for job entry levels;

g. procedures and opportunities available for continuing education; and

h. employers expectations for a positive attitude toward the work ethic and good relations in working with others.

UNIT 1.0 COOPERATIVE CAREER PREPARATION (COMMUNITY BASED)

General Aims

The student should:

a. develop increased understanding of the employment opportunities in the local community, the province and the country;
b. gain practical experience relating to employment responsibilities;
c. benefit from the knowledge and experience of resource persons from business and industry.

Community representatives should participate in organized activities connected with the program.

MODULE 1.01 PREPLACEMENT ROUTINE

Goal Statements

The learning experiences in this module are designed to:

a. provide the opportunity for the student to review appropriate regulations of Workers' Compensation Board;
b. review all necessary procedures for student transportation to and from a placement work site;
c. increase student responsibility to school and employer;
d. acquaint the student with documentation, forms, contracts, and the reports of employer, teacher, and student.

Learning Outcomes	Student Activities
The student should be able to:	
1.01.01	
dress appropriately for the type of employment experience	-discuss appropriate dress for different occupations
1.01.02	
describe the transportation procedures for reaching the job site	-consider public or private means

1.01.03 list the important factors related to expected behaviour on the job	-review introductory process to contact employer -discuss manners, speech, things to observe -discuss significance of reports -read examples of reports that will be written by the employer and the teacher

MODULE 1.02 PLACEMENT (EXTERNAL TO SCHOOL)

Goal Statements

The learning experiences in this module are designed to:

a. provide the student with experiences that will relate school experiences with actual working conditions;
b. provide each student with actual job experience in a working environment;
c. increase student awareness and understanding of employee responsibilities;
d. have the student practise increased responsibility within a work environment
e. facilitate effective transition of students between school and employment;
f. assist the student to see value in education and training; and
g. create a student awareness of the opportunities for further training.

Learning Outcomes	Student Activities
The student should be able to:	
1.02.01	
function effectively in a job situation	-follow directions mutually agreed to by employer and teacher
1.02.02	
work cooperatively with other students or employees	-ask questions related to career goals -maintain good relations with others -acquire training experiences in the community

MODULE 1.03 POSTPLACEMENT ROUTINE

Goal Statements

The learning experiences in this module are designed to:

a. assist the student to make a job analysis of an occupation related to the placement, and
b. review employment and career possibilities related to actual job experience.

Learning Outcomes	Student Activities
The student should be able to:	
1.03.01	
prepare a job analysis of an occupation where work experience was obtained	-review format of sample analyses -discuss career paths
1.03.02	
list safety factors that must be observed in a chosen occupation	-review safety aspects related to self and others

MODULE 1.04 STUDENT REPORTING PROCESS

Goal Statements

The learning experiences in this module are designed to:

a. provide each student with a format to report on their field experience with an employer,
b. examine roles of employee duties in an occupation and relate to particular school experiences, and
c. have the student prepare a formal list of contacts and practical job experiences.

Learning Outcomes	Student Activities
The student should be able to:	
1.04.01	
complete a report of the job placement and discuss in detail the positive (and negative) aspects of the experience	-review content of reports and prepare details on the work experience -prepare an oral report to the class on the experience at a job site
1.04.02	
explain the job advantages and disadvantages of an occupation	-discussions in class
1.04.03	
list criteria of satisfactory job performances	-discussions in class
1.04.04	
list criteria of unsatisfactory job performances	-discussions in class

MODULE 1.05 LETTER OF THANKS TO EMPLOYER

Goal Statement

The learning experiences in this module are designed to provide the student with a format to prepare a letter of thanks to employers who provided work experience.

Learning Outcomes	Student Activities
The student should be able to: 1.05.01 organize and write a letter of thanks to the business firm where job experience was obtained	-prepare a draft for approval by the teacher -type or write a letter using correct grammar -mail or deliver to business within one week of return to school

UNIT 2.0 SHOP SAFETY AND BASIC PROCEDURES

General Aim

The student should develop and apply positive attitudes toward the application of standard shop practices, proper care of tools, and observance of safety rules and regulations.

MODULE 2.01 REVIEW OF SAFETY PROCEDURES

Goal Statements

The learning experiences in this module are designed to:

a. develop a positive attitude toward safe practices and acceptable work habits, and
b. help the student to act with initiative to adopt correct practices in any emergency situation that develops.

Learning Outcomes	Student Activities
The student should be able to:	
2.01.01	
demonstrate good housekeeping habits	-maintain a clean and safe work area
2.01.02	
identify safety and health hazards and take corrective action	-use safety glasses, shields, guards and other protective equipment -become familiar with the handling and storing of materials used as cleaning agents
2.01.03	
demonstrate the application of proper practices in moving or lifting equipment	-study and apply rules for lifting objects -use safety stands -use cranes and dollies for objects

MODULE 2.02 REVIEW OF EMERGENCY PROCEDURES - FIRE AND MEDICAL

Goal Statements

The learning experiences in this module are designed to:

a. acquaint the student with the basic procedures that should be followed for any emergency situation,
b. provide experiences in the practical use of fire fighting equipment, and
c. introduce the student to basic first aid procedures.

Learning Outcomes	Student Activities
The student should be able to:	
2.02.01	
describe and demonstrate the proper use and application of four appropriate fire extinguishers for different types of fires	-analyze various emergency situations involving fires -apply safety practices to simulated fires
2.02.02	
identify procedures for minor and major accidents	-study Workers' Compensation Board safety materials
2.02.03	
list specific situations in a shop where potential fires can develop	-discuss precautionary measures that will reduce the danger of fire

MODULE 2.03 SHOP PRACTICES AND CUSTOMER RELATIONS

Goal Statements

In this module, the learning experiences should help the student to:

a. utilize service manuals;
b. explain the organizational structure of a mechanical service shop;
c. recognize and apply acceptable practices in various customer relation situations; and
d. develop positive attitudes toward others in a working environment.

Learning Outcomes	Student Activities
The student should be able to:	
2.03.01	
outline the organizational structure of a mechanical service shop	-analyze the organizational structure of a typical mechanical service shop
2.03.02	
interpret and complete work orders and supporting documents	-complete work orders -discuss the application of business documents such as time tickets, sales orders, warranty forms, purchase requisitions
2.03.03	
interpret and apply shop service manuals to perform service and repair work according to manufacturers' recommendations	-use manufacturers' service manuals, bulletins and equipment operating instructions
2.03.04	
demonstrate a working knowledge of the fundamental principles of customer relations	-use role playing situations to become familiar with employee traits that can be objectionable to customers

2.03.05 identify potential problems and solutions for effective customer relations	-interpret customer behaviours and frustrations

UNIT 3.0 TOOLS AND EQUIPMENT

General Aim

The student should develop an appreciation of proper care and use of specialized tools and equipment.

MODULE 3.01 SPECIALIZED TOOLS AND EQUIPMENT

Goal Statements

The learning experiences in this module are designed to:

a. increase student awareness of the many different types of tools and equipment necessary to effect repairs in the mechanical trades, and
b. provide the student with visual examples of actual equipment in operation.

Learning Outcomes	Student Activities
The student should be able to: 3.01.01 demonstrate a knowledge of the tools and equipment to effect specialized repairs	-tour of shop(s) engaged in specialized repairs and services

MODULE 3.02 REVIEW OF PRECISION MEASURING EQUIPMENT

Goal Statements

The learning experiences in this module are designed to:

a. develop the ability of the student to select and use precision measuring equipment as required in the mechanical trades, and
b. develop an appreciation of the need to care for precision equipment.

Learning Outcomes	Student Activities
The student should be able to: 3.02.01 describe the application and use of each of the following: a. inside micrometer b. outside micrometer c. cylinder gauge d. telescoping gauge e. brake drum gauge f. dial indicator g. small hole gauge h. vernier caliper i. feeler gauge j. straight edge k. dial bore gauge 3.02.02 measure precision parts accurately and evaluate their condition by reference to the manufacturer's specifications	Note: Use S.I. instruments where possible. -review the application and uses of each of the following: a. inside micrometer b. outside micrometer c. cylinder gauge d. telescoping gauge e. brake drum gauge f. dial indicator g. small hole gauge h. vernier caliper i. feeler gauge j. straight edge k. dial bore gauge -use the following equipment on a variety of precision parts found in the shop: a. inside micrometer b. outside micrometer c. cylinder gauge d. telescoping gauge e. brake drum gauge f. dial indicator g. small hole gauge i. vernier caliper j. straight edge k. dial bore gauge -refer to manufacturer's specifications and evaluate amount (if any) of wear

UNIT 4.0 INTERPRETATION OF MECHANICAL DRAWINGS AND TECHNICAL DATA

General Aim

The student should develop abilities to use basic information from mechanical drawings, exploded views and related technical data.

MODULE 4.01 READING DRAWINGS AND EXPLODED VIEWS

Goal Statements

The learning experiences in this module are designed to:

a. assist the student to develop competency in reading drawings and interpreting exploded views, and
b. provide opportunities for the student to apply skills in the use of drawings and exploded views in assigned operations.

Learning Outcomes	Student Activities
The student should be able to:	
4.01.01	
identify objects from prepared mechanical drawings in pictorial and orthographic projection	-study and discuss pictorial views -study the standard placement of orthographic views
4.01.02	
locate parts from exploded views of appropriate assemblies	-study and discuss the advantages of using exploded views

MODULE 4.02 READING PARTS CATALOGUES

Goal Statement

The learning experiences in this module are designed to further develop the ability of the student to read parts catalogues.

Learning Outcomes	Student Activities
The student should be able to:	
4.02.01	
use the index and various sections of a parts catalogue as required to locate parts	-review the use of a parts catalogue
4.02.02	
locate specific information in a parts catalogue according to assigned tasks	-use a parts catalogue and locate specific items

UNIT 5.0 SOLDERING AND GAS WELDING

General Aim

The student should develop increased understanding and skill in joining metals by soldering and gas welding processes.

MODULE 5.01 REVIEW OF SOLDERING PROCEDURES

Goal Statement

The learning experiences in this module are designed to increase student abilities to join metals by soldering.

Learning Outcomes	Student Activities
The student should be able to:	
5.01.01	
describe the design and explain the function and application of the major components of soldering equipment	-review common applications for soft and hard soldering metals
5.01.02	
prepare surfaces for soldering	-clean physically and chemically
5.01.03	
select proper solder and fluxes	-review composition of materials
5.01.04	
select proper heating method for specific operation	-discuss approved heat sources -review application of soldering irons and gas torches
5.01.05	
demonstrate a working knowledge of the fundamental principles of soldering using flame or radiant heat	-discuss basic principles and safety factors

5.01.06 perform soldering operations with standard soldering equipment	-practice assigned exercises

MODULE 5.02 REVIEW OF GAS WELDING PROCEDURES

Goal Statements

The learning experiences in this module are designed to:

a. increase student skill in the safe operation of gas welding equipment, and
b. review advantages and disadvantages of the various methods available for gas welding metals.

Learning Outcomes	Student Activities
The student should be able to:	
5.02.01	
describe correct handling and operating practices for gas welding equipment	-discuss procedures for handling and securing gas welding equipment
5.02.02	
demonstrate correct procedures and methods in testing for leaks	-use soapy water tests
5.02.03	
perform basic welds on flat stock	-practice welds to develop skills

MODULE 5.03 SAFETY RELATED TO GAS WELDING IN HAZARDOUS LOCATIONS

Goal Statements

The learning experiences in this module are designed to:

a. develop student awareness of the safety hazards and precautions required while welding on and around automobiles and other hazardous locations, and
b. provide examples of the importance of safety around hazardous and flammable materials.

Learning Outcomes	Student Activities
The student should be able to:	
5.03.01	
demonstrate a working knowledge of safe practices in the use and handling of gas welding equipment in hazardous situations	-study and discuss the specific safety problems involved in an automotive shop -use equipment as helmet, face shield, gloves, boots, leathers, protective screens -discuss danger of butane lighters exploding when in contact with sparks
5.03.02	
outline the effects of heat on metals	-discuss safety aspects

UNIT 6.0 ELECTRICAL SYSTEMS

General Aims

The student should develop a working knowledge of:

a. the basic principles of D C motor operation;
b. the procedures for testing and servicing electrical starting systems;
c. the theory and operation of modern charging systems;
d. the theory and operation of standard and electronic ignition systems; and
e. the procedures to inspect, test and service flywheel magnetos in relation to the theory of electromagnetism.

MODULE 6.01 PRINCIPLES OF ELECTRIC MOTOR OPERATION

Goal Statement

The learning experiences in this module are designed to provide an introduction to the theory and construction of the electric motor.

Learning Outcomes	Student Activities
The student should be able to:	
6.01.01 outline the principles that cause a current carrying conductor to move in a magnetic field	-use prescribed text for reference
6.01.02 draw a simple diagram of a conductor in a magnetic field	-study and discuss magnetic force effect
6.01.03 point out on a diagram the current flow in a simple series wound motor	-study classroom notes on series wound motors -discuss the effect of low resistance and high current flow on motor performance

6.01.04 explain and outline the effect that a shunt winding has on a four pole starter	-use prescribed text and classroom notes

MODULE 6.02 PRINCIPLES OF SWITCHING/RELAY DEVICES/STARTER DRIVES

Goal Statements

The learning experiences in this module are designed to:

a. orient the student to the function of magnetic switches and solenoids,
b. develop student understanding of the various starter drive arrangements and their function, and
c. provide an introduction to the methods used to engage and disengage a starter drive with an engine ring gear.

Learning Outcomes	Student Activities
The student should be able to:	
6.02.01	
explain and outline the operation of a magnetic switch and list an application	-list some applications
6.02.02	
trace current flow in a magnetic switch	-study assigned references
6.02.03	
explain and outline the operation of a solenoid as related to a starter motor	-trace current flow in an operating solenoid; particularly note the function of the pull-in and hold-in windings. -contrast Ford movable pole shoe with more conventional types
6.02.04	
describe the need for the neutral safety switch on a given automatic transmission equipped vehicle	-check several vehicles for neutral safety switch locations and record information
6.02.05	
list types of starter drives and their operation	-use text and study the overrunning clutch drive and disengagement method

MODULE 6.03 INSPECT, TEST AND SERVICE STARTING SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. develop student understanding of inspection procedures, and
b. provide the student with understanding of the basic testing procedures in starter diagnosis.

Learning Outcomes	Student Activities
The student should be able to:	
6.03.01	
diagnose a vehicle starting system problem	-from the text, list the common problems and possible causes -list solutions
6.03.02	
perform a starter voltage drop test	-check manufacturers' specifications

MODULE 6.04 PRINCIPLES OF ALTERNATOR CHARGING SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. develop student understanding of the construction and operation of alternators,
b. familiarize the student with electronic devices that are now used in motor vehicle charging systems, and
c. introduce the methods used to achieve rectification and regulation.

Learning Outcomes	Student Activities
The student should be able to:	
6.04.01	
describe the construction and operation of an alternator	-use a simplified alternator diagram (rotating bar magnet in a wire loop) and study the ways that current production can be increased: a. increase strength of magnetic field b. increase the speed of the moving magnetic field c. increase the number of loops
6.04.02	
outline the basic operation of diodes and transistors and their application in the motor vehicle	-use handouts and classroom notes to study diodes and transistor operations
6.04.03	
describe rectification of alternating current using a wall chart	-study classroom notes and the prescribed text descriptions
6.04.04	
explain need for alternator output control	-explain how regulation is achieved

MODULE 6.05 INSPECT, TEST AND SERVICE CHARGING SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. acquaint the student with the logical steps to troubleshoot a motor vehicle charging system, and
b. provide opportunities for the student to participate in the testing of a motor vehicle charging system.

Learning Outcomes	Student Activities
The student should be able to:	
6.05.01	
identify common charging system problems	-compile list of problems and causes, e.g. low battery, overcharged battery, faulty indicator lamp, noisy alternator -refer to manufacturers' trouble-shooting guides for direction
6.05.02	
complete a charging circuit resistance test	-participate in a group exercise completing an 'on the car' charging circuit test; check with respect to manufacturers' specifications
6.05.03	
check regulator operating voltage	-participate in a group activity completing an 'on the car' voltage regulator test; follow manufacturers' procedures
6.05.04	
test alternator current output	-participate in a group activity completing an 'on the car' current output test; follow manufacturers' procedures

MODULE 6.06 PRINCIPLES OF IGNITION SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. orient the student to the theory and operation of the conventional ignition system, and
b. develop student understanding of the electronic ignition system.

Learning Outcomes	Student Activities
The student should be able to:	
6.06.01 state how the contact point ignition system works	-using classroom notes and prescribed text, discuss conventional system
6.06.02 list components and their functions in the primary and secondary ignition system	
6.06.03 select the proper spark plug for a given engine	-using the prescribed text and a spark plug chart, select the proper plug and heat range for several types of engines and conditions, i.e. generally high speed driving, low speed driving, oil fouling
6.06.04 state the major differences between conventional and electronic systems	-compile a list of the electronic controls and sensing devices that make up the electronic ignitions
6.06.05 state the advantages of an electronic ignition system	

MODULE 6.07 INSPECT, TEST AND SERVICE CONVENTIONAL IGNITION SERVICE

Goal Statements

The learning experiences in this module are designed to:

a. introduce the student to the methods used to inspect and trouble-shoot the ignition system, and
b. provide opportunities for the student to use the various test equipment for motor vehicle engine diagnosis.

Learning Outcomes	Student Activities
The student should be able to:	
6.07.01	
trouble-shoot problems in a conventional ignition system	-use a prepared trouble-shooting chart listing problem conditions and solutions -practise repairing simulated problems on a test engine
6.07.02	
remove the distributor, rotate engine, re-establish #1 top dead centre, replace distributor correctly and retime engine	-practise distributor removal and replacement using procedure sheet on test engine
6.07.03	
perform ignition system tests on primary and secondary circuits using a voltmeter, tach/dwell meter, ohmeter, oscilloscope	-practise the use of specific ignition test equipment in diagnostic procedures

MODULE 6.08 INSPECT AND TEST ELECTRONIC IGNITION SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. orient the student to the approaches and diagnostic methods used in the testing of electronic ignition systems, and
b. develop student awareness of the method used for component replacement in the electronic ignition system.

Learning Outcomes	Student Activities
The student should be able to:	
6.08.01	
outline methods used to trouble-shoot electronic ignition systems	-review use of voltmeter and ohmeter (detailed test procedures are available on specific electronic ignition systems from the vehicle manufacturers) -participate in an exercise simulating an electronic ignition component testing procedure (group activity)
6.08.02	
state procedures to be used for replacement of electronic ignition components	-replace electronic ignition components on a test vehicle

MODULE 6.09 PRINCIPLES OF OPERATION; INSPECTION AND TESTING OF FLYWHEEL MAGNETOS

Goal Statements

The learning experiences in this module are designed to:

a. increase student awareness of the theory of electromagnetism,
b. develop understanding of methods used to create a current flow in a magneto ignition system, and
c. assist the student to inspect and test flywheel magnetos.

Learning Outcomes	Student Activities
The student should be able to:	
6.09.01	
state the electromagnetic theory	-review and discuss the theory of electromagnetism
6.09.02	
outline the application of electromagnetism as used in a flywheel magneto	-study and discuss the theory and operation of a flywheel magneto
6.09.03	
inspect flywheel magneto for possible defect	-study and discuss possible defects such as loose or damaged wires and insulation
	-study and discuss the use of magneto testing equipment; carry out tests, exercising all safety precautions with regards to electric shock; consult manuals

UNIT 7.0 POWER BRAKE SYSTEMS

General Aim

The student should gain a basic understanding of the construction and operation of power brake systems

MODULE 7.01 POWER ASSIST BRAKE UNITS

Goal Statements

The learning experiences in this module are designed to:

a. introduce the student to the construction and operation of power assist brake units, and
b. provide opportunities for the student to diagnose common power assist brake unit problems.

Learning Outcomes	Student Activities
The student should be able to: 7.01.01 outline the operation of the following power assist brake units: a. vacuum suspended b. air suspended c. hydro boost	-discuss the operation of the power assist brake units
7.01.02 outline the construction of the following power assist brake units a. vacuum suspended b. air suspended c. hydro boost	-disassemble a power assist brake unit following the manufacturer's prescribed methods (small group activity)

UNIT 8.0 ENGINES - DIESEL AND GASOLINE

General Aims

The student should gain experience with:

a. the operation of diesel engines and some of the trouble-shooting techniques;
b. the correct procedures to follow in the overhaul of a gasoline engine including the disassembly, inspection, evaluation, repair and assembly according to manufacturers' recommended procedures; and
c. the diagnosis of small engine problems and procedures to determine and conduct corrective actions.

MODULE 8.01 DIESEL ENGINE OPERATION

Goal Statement

The learning experiences in this module are designed to provide opportunities for the student to learn about the construction and operation of a diesel engine.

Learning Outcomes	Student Activities
The student should be able to: 8.01.01 list major construction features of a diesel engine 8.01.02 list operating characteristics of a diesel engine	Note: Group Activity: either in school, away from school or theoretical approach -operate as a group and under the supervision of the teacher

MODULE 8.02 OVERHAULING A GASOLINE ENGINE (Either Module 8.02 or 8.03 must be completed)

Goal Statements

The learning experiences in this module are designed to:

a. review practices and procedures demonstrated and discussed during the C P 11 General Mechanics program,
b. develop student appreciation of the need to follow the manufacturer's recommended procedures in the overhaul of a gasoline engine,
c. increase student awareness of the need to refer to the manufacturer's specifications in the evaluation and repair of engine components, and
d. assist the student in referring to the manufacturer's operation manual to safely and correctly use the specialty equipment and tools that apply for an engine overhaul.

Learning Outcomes	Student Activities
The student should be able to:	Note: All these below are group activities
8.02.01	
evaluate the condition of an engine before removal from the vehicle (apply the manufacturer's recommended test procedure)	-evaluate the condition of an engine before removal from the vehicle (following the manufacturer's recommended test procedure)
8.02.02	
remove an engine from a vehicle following the manufacturer's recommended procedures	-remove a gasoline engine from a vehicle (following the manufacturer's recommended procedures)
8.02.03	
follow the engine manufacturer's recommended procedures to disassemble an engine	-disassemble an engine (following the engine manufacturer's recommended procedures)
8.02.04	
evaluate engine components following the manufacturer's procedures, and referring to the manufacturer's specifications	-evaluate engine components

8.02.05	
service engine components to the standards established by the manufacturer using the prescribed equipment or tool in accordance to the equipment or tool manufacturer's operating procedures	-service engine components to the standards established by the manufacturer, using the prescribed equipment
8.02.06	
assemble an engine following the manufacturer's procedures	-assemble an engine
8.02.07	
install an engine in a vehicle following the manufacturer's procedures	-install an engine in a vehicle
8.02.08	
start and test an engine after overhauling and installing, to ensure that it meets the manufacturer's performance level and standards	-conduct this assignment in small group situation

MODULE 8.03 OVERHAULING A SMALL GASOLINE ENGINE

Goal Statements

The learning experiences in this module are designed to:

a. increase the student ability to diagnose small engine problems,
b. assist the student in formulating the procedures required to correct the engine faults, and
c. assist the student to carry out the repairs and restoration of an engine for successful operation.

Learning Outcomes	Student Activities
The student should be able to:	Note: Individual or group activities
8.03.01 evaluate the performance of an operating engine	-discuss, observe and list the actual and possible indications of engine problems
8.03.02 test various systems and conditions involved for a non-operating engine and evaluate steps to be followed to locate the source of trouble	-discuss and list the systems involved and the order in which they may be tested -discuss and evaluate the various tests and evaluations -carry out the disassembly and procedures as required to locate the source(s) of trouble
8.03.03 identify engine defects	-using available texts and engine manuals, outline the procedures for correcting the engine defects
8.03.04 carry out the required repairs and restoration of the engine	-using the correct tools, gauges, torques, specifications etc. carry out the required repairs, adjustments and reconditioning as required

8.03.05 test run and fine tune an engine	-discuss safe operating conditions -discuss and research final adjustments -add fuel and start engine; adjust controls as required

UNIT 9.0 FUEL DELIVERY SYSTEMS

General Aim

The student should acquire knowledge of the operation of various types of automotive fuel injection systems and turbochargers.

MODULE 9.01 PRINCIPLES AND TYPES OF AUTOMOTIVE FUEL INJECTION SYSTEMS (GASOLINE)

Goal Statement

The learning experiences in this module are designed to increase student awareness of the differences between fuel injection and carburetion.

Learning Outcomes	Student Activities
The student should be able to: 9.01.01 identify the advantages and disadvantages of a common fuel injection system 9.01.02 explain the function and purpose of the major components of a common fuel injection system	-class discussion, e.g. K-Jetronic

MODULE 9.02 OPERATING PRINCIPLES OF AUTOMOTIVE TURBOCHARGERS

Goal Statements

The learning experiences in this module are designed to help the student develop an understanding of the operating principles, advantages and disadvantages of automotive turbochargers.

Learning Outcomes	Student Activities
The student should be able to:	
9.02.01	
explain and outline the function and purpose of major components of an automotive turbocharger	-discuss the function and purpose of major components of an automotive turbocharger
9.02.02	
identify and list the advantages and disadvantages of automobile turbochargers	-discuss advantages and disadvantages of automobile turbochargers

UNIT 10.0 EMISSION CONTROL SYSTEMS

General Aim

The student should develop increased awareness of the methods used to control vehicle emissions and procedures to diagnose and service basic system malfunctions.

MODULE 10.01 POSITIVE CRANKCASE VENTILATION SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. help the student recognize the need for and operation of positive crankcase ventilation in the control of vehicle emissions,
b. help the student recognize the need for regular service and inspection of the positive crankcase ventilation system, and
c. develop student skills in recognizing the common malfunctions of the positive crankcase ventilation systems.

Learning Outcomes	Student Activities
The student should be able to:	
10.01.01	
list the purpose of the positive crankcase ventilation systems	-discuss the purpose of the positive crankcase ventilation systems
10.01.02	
compare and outline the operation of the positive crankcase ventilation systems	-discuss and list the various positive crankcase ventilation systems
10.01.03	
list in point form the common positive crankcase ventilation system malfunctions	-discuss and list the various positive crankcase ventilation system malfunctions

10.01.04 demonstrate how to service a positive crankcase ventilation system	-group activity to inspect and service a positive crankcase ventilation system

MODULE 10.02 VAPOUR RECOVERY SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. increase awareness of the need for and operation of the vapour recovery system in the control of vehicle emissions,
b. help the student to recognize the need for regular service and inspection of the vapour recovery system, and
c. develop student skills in recognizing the common malfunctions of the vapour recovery system.

Learning Outcomes	Student Activities
The student should be able to:	
10.02.01 list the purposes of the vapour recovery system	-discuss the purpose of the vapour recovery system
10.02.02 outline the operation of a vapour recovery system	-discuss a vapour recovery system
10.02.03 list in point form the common vapour recovery system malfunctions	-discuss and list the various vapour recovery system malfunctions
10.02.04 demonstrate how to service a vapour recovery system	-group activity to inspect and service a vapour recovery system

MODULE 10.03 EXHAUST GAS RECIRCULATION SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. increase student understanding of the need for and operation of exhaust gas recirculation systems and heat riser control,
b. assist the student to recognize the need for regular service and inspection of the exhaust gas recirculation system, and
c. develop student skills in recognizing the common malfunctions of the exhaust gas recirculation system.

Learning Outcomes	Student Activities
The student should be able to:	
10.03.01	
list the purposes of the exhaust gas recirculation system	-discuss the purpose of the exhaust gas recirculation system
10.03.02	
outline the operation of an exhaust gas recirculation system	-discuss the operation of an exhaust gas recirculation system
10.03.03	
list in point form the common exhaust gas recirculation system malfunctions	-discuss and list the various exhaust gas recirculation system malfunctions
10.03.04	
demonstrate how to service an exhaust gas recirculation system	-group activity to inspect and service an exhaust gas recirculation system
10.03.05	
demonstrate the function of heat riser	-discuss interrelation of EGR and heat riser

MODULE 10.04 AIR INJECTION REACTION SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. assist the student to recognize the need for and operation of the air injection reaction system in the control of vehicle emissions,
b. outline the need for regular service and inspection of the air injection reaction system, and
c. develop student skill in recognizing the common malfunctions of the air injection reaction system.

Learning Outcomes	Student Activities
The student should be able to:	
10.04.01 list the purposes of the air injection reaction system	-discuss the purpose of the air injection reaction system
10.04.02 outline the operation of an air injection reaction system	-discuss an air injection reaction system
10.04.03 list in point form the common air injection reaction system malfunctions	-discuss and list the various air injection reaction system malfunctions
10.04.04 demonstrate how to service an air injection reaction system	-group activity to inspect and service an air injection reaction system

MODULE 10.05 CATALYTIC CONVERTORS

Goal Statements

The learning experiences in this module are designed to:

a. develop awareness of the need for and operation of catalytic convertors in the control of vehicle emissions,
b. increase student awareness of the need for regular inspection of the catalytic convertor,
c. develop student skills in recognizing the common malfunctions of the catalytic convertor, and
d. help the student to recognize that extreme operating temperatures create hazards.

Learning Outcomes	Student Activities
The student should be able to:	
10.05.01 list the purposes of the catalytic convertor	-discuss the purpose of the catalytic convertor
10.05.02 compare and outline the operation of the catalytic convertor	-discuss the catalytic convertors
10.05.03 list in point form the common catalytic convertor malfunctions	-discuss and list the various catalytic convertor malfunctions

MODULE 10.06 SPARK ADVANCE AND AIR FUEL RATIO CONTROLLED SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. help the student to recognize the need for and operation of spark advance and air fuel ratio controlled systems in the control of vehicle emissions,
b. develop awareness of the need for regular service and inspection of the spark advance and air fuel ratio control systems, and
c. develop student skills in recognizing the common malfunctions of the spark advance and air fuel ratio control systems.

Learning Outcomes	Student Activities
The student should be able to:	
10.06.01	
list the purpose of the spark advance and air fuel ratio controlled systems	-discuss the purpose of the spark advance and air fuel ratio controlled systems
10.06.02	
compare and outline the operation of the spark advance and air fuel ratio controlled systems	-discuss and list the various spark advance and air fuel ratio controlled systems

UNIT 11.0 AUTOMATIC TRANSMISSION

General Aim

The student should gain experience with the fundamental operation and servicing aspects of automatic transmissions.

MODULE 11.01 FUNDAMENTALS OF OPERATION

Goal Statements

The learning experiences in this module are designed to:

a. provide opportunities for the student to become familiar with the construction and operating principles of a conventional torque convertor,
b. increase student understanding of vortex flow, rotary flow, torque multiplication and stall condition, and
c. develop student awareness of the function of a planetary gear set.

Learning Outcomes	Student Activities
The student should be able to:	
11.01.01	
outline the operation of the torque convertor assembly	-discuss the operation of a torque convertor -write a report on the operation of torque convertors using a text book as a reference
11.01.02	
define the following: a. vortex flow b. rotary flow c. coupling point d. stall condition e. torque multiplication ratio	-class discussion

11.01.03 using a classroom model demonstrate the power flow through both a simple and compound planetary gear set	-discuss power flow through both a simple and compound planetary gear set -trace power flow through both a simple and compound planetary gear set using a classroom model
11.01.04 perform basic service to an automatic transmission following the manufacturer's procedures and recommendations	-small group to drain oil, remove pan and change filter (follow the manufacturer's procedures and recommendations)

UNIT 12.0 DIFFERENTIALS AND DRIVING AXLES

General Aim

The student should acquire knowledge of the fundamental operation of differentials and driving axles.

MODULE 12.01 BASIC OPERATION OF DIFFERENTIALS AND DRIVING AXLES

Goal Statements

The learning experiences in this module are designed to:

a. provide opportunities for the student to review the basic function and operation of a simple differential,
b. help the student to trace the flow of power through the gear train under the varying conditions to which the drive axle assembly would be subjected,
c. orient the student to the actions of the bearings and seals utilized in a differential and how these bearings carry the thrust and radial loads,
d. assist the student to identify the different construction design characteristics of axle shafts, and
e. provide an overview of the variations of differentials and applications so that the student can identify and explain the operation of each particular type.

Learning Outcomes	Student Activities
The student should be able to: 12.01.01 identify all the components of a simple automotive differential	-indicate by using a coloured pencil on a handout sheet, the power flow -participate in the breakdown of the differential for inspection and familiarization
12.01.02 indicate the flow of power through the gear train	

12.01.03 explain why the power shifts from one drive wheel to the other when the vehicle is in a turn	
12.01.04 identify the following gear types and design purposes: a. straddle mounted pinion b. overhung mountings c. hypoid type gears d. spiral-bevel gears e. hunting gear sets f. non-hunting gear sets g. partial non-hunting gear sets	-work in small groups and investigate the various design characteristics of each type of differential in turn -use handouts covering differentials and colour the diagrams as directed to indicate thrust and radial loads
12.01.05 identify the following differentials: 1. cone type 2. multiple disc 3. V-ramp non-slip 4. limited slip differential	-caption the gear types and design purposes -participate in the dis-assembly of a common differential (small group activity)

MODULE 12.02 PLANETARY FINAL DRIVES AND APPLICATIONS

Goal Statements

The learning experiences in this module are designed to:

a. develop student understanding of the planetary gear fundamentals and construction as applied to final drives, and
b. assist the student to recognize the importance of proper lubricants for final drive units and intervals of service.

Learning Outcomes	Student Activities
The student should be able to: 12.02.01 trace the flow of power in both modes of operation: a. high b. low 12.02.02 identify proper lubricants by name and type: a. extreme pressure b. hypoid c. viscosity	-viewing actual unit or transparencies of same -research of specifications and lubricant manufacturers' literature to become familiar with trade names etc.

UNIT 13.0 STEERING SYSTEMS AND SUSPENSION SYSTEMS

General Aim

The student should develop abilities to follow approved procedures for inspecting and servicing suspension systems.

MODULE 13.01 TYPES AND IDENTIFICATION OF FRONT AND REAR SUSPENSION SYSTEMS

Goal Statement

The learning experiences in this module are designed to provide the student with a review of previous information from grade 11 respect to types and identification of suspension systems.

Learning Outcomes	Student Activities
The student should be able to: 13.01.01 list the various types of front suspension units in use on light vehicles	-review grade 11 classroom notes
13.01.02 list various designations of springs	
13.01.03 state Hooke's Law	
13.01.04 point out the fluid action in a direct acting or telescopic type shock absorber	
13.01.05 describe the advantage of an independent four wheel suspension over a solid axle	

MODULE 13.02 PRINCIPLES OF STEERING GEOMETRY

Goal Statement

The learning experiences in this module are designed to provide the student with a review of previous information (C P 11 General Mechanics) and further develop awareness of steering geometry.

Learning Outcomes	Student Activities
The student should be able to:	
13.02.01	
identify parts subject to wear on a vehicle steering system	-refer to grade 11 classroom notes
13.02.02	
list front end geometry terms and state the purpose of each	-use prescribed text for explanation of terms
13.02.03	
point out how to adjust caster and camber on a classroom model	-practice caster/camber adjustments on a classroom model

MODULE 13.03 INSPECT AND SERVICE FRONT SUSPENSION SYSTEMS

Goal Statements

The learning experiences in this module are designed to:

a. introduce the student to inspection procedures used in front end service,
b. acquaint the student with the actual adjustment of the front end alignment geometry, and
c. orient the student to safety requirements related to steering and suspension system service.

Learning Outcomes	Student Activities
The student should be able to:	
13.03.01	
complete an inspection and evaluation report on a given vehicle	-practice checking steering components, including tires on several different vehicles and prepare reports (small group activity)
13.03.02	
list alignment prechecks	-study prepared list of alignment prechecks
13.03.03	
demonstrate how to read alignment angles or measurements using the wheel alignment equipment	-study a complete front end adjustment procedure (small group activity under direction of instructor)
13.03.04	
perform corrective adjustments on caster, camber and toe-in on a given vehicle	
13.03.05	
diagnose wheel alignment problems and identify repair procedures	-use trouble-shooting procedure list in prescribed text and discuss

MODULE 13.04 STANDARD STEERING GEAR BOX AND PRINCIPLES OF OPERATION

Goal Statement

The learning experiences in this module are designed to provide the student with an introduction to the function of the types and design of standard steering gears.

Learning Outcomes	Student Activities
The student should be able to: 13.04.01 identify the four types of standard steering gear systems	-study information on types of steering gearboxes (worm and sector, Ross cam and lever, recirculating - ball, rack and pinion)

MODULE 13.05 DISASSEMBLE INSPECT AND ASSEMBLE STANDARD STEERING GEAR BOX

Goal Statements

The learning experiences in this module are designed to:

a. assist the student to evaluate the standard steering gear for repair, and
b. develop ability of the student to make adjustments to the standard steering gear.

Learning Outcomes	Student Activities
The student should be able to:	
13.05.01	
disassemble a standard steering gear system and evaluate for repairs	-study classroom examples of common steering gear system problems
13.05.02	
assemble and complete adjustment on a standard, worm and sector, or recirculating ball type steering box	-practice adjustments on steering gear boxes; worm gear bearing preload, and sector shaft preload point

MODULE 13.06 OPERATING PRINCIPLES OF POWER STEERING

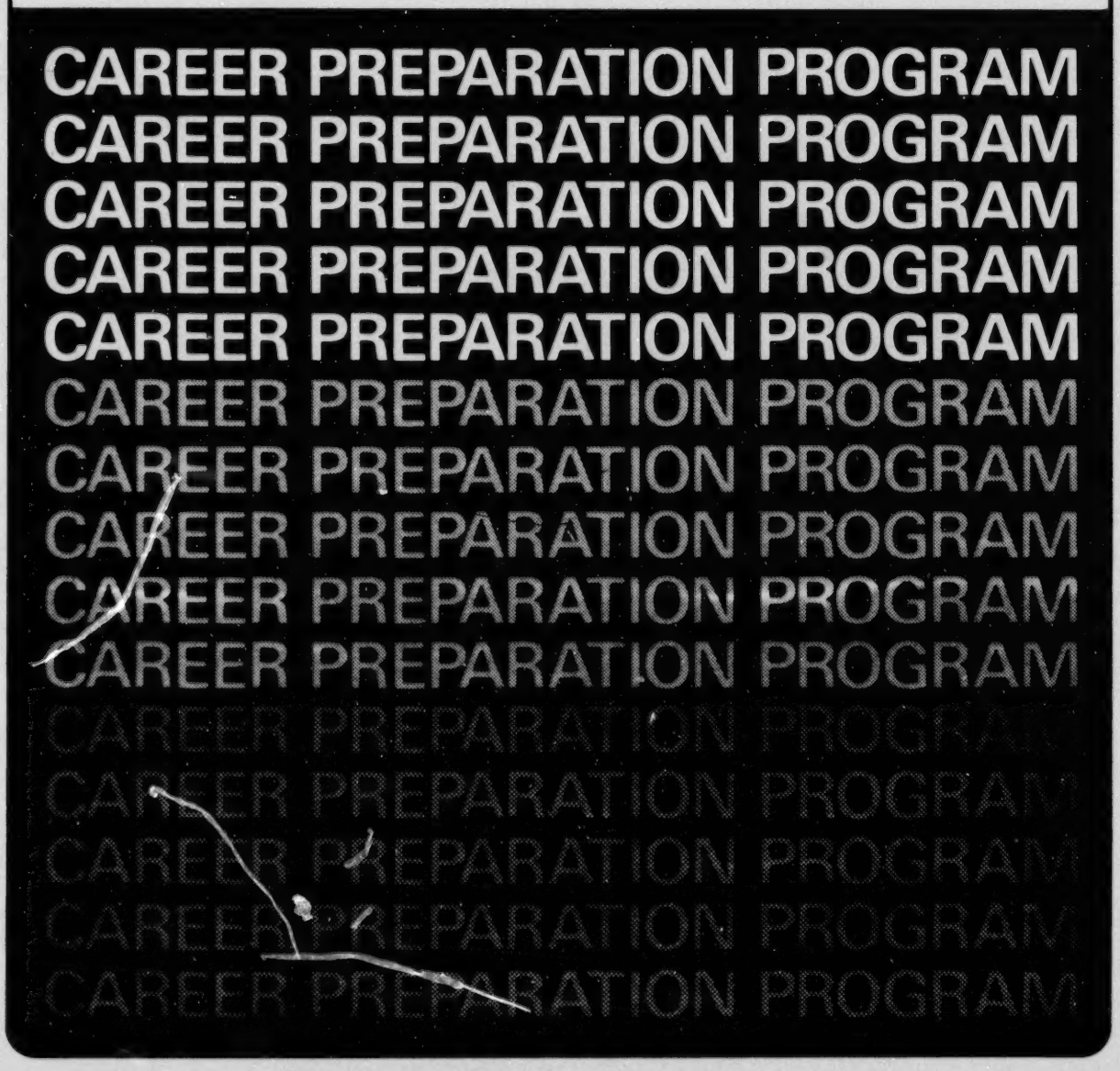
Goal Statements

The learning experiences in this module are designed to:

a. introduce the student to the theory of operation of the two basic power steering units, and
b. develop the ability of the student to identify types of pumps.

Learning Outcomes	Student Activities
The student should be able to:	
13.06.01	
identify the rotary valve type and linkage type power steering assemblies	-refer to prescribed text
13.06.02	
identify differences between slipper and vane type power steering pumps	-view examples of pumps

Section Four
Resource Materials



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SECTION FOUR RESOURCE MATERIALS 213

GENERAL MECHANICS RESOURCE MATERIALS

Automotive Mechanics Crouse, William H. First Canadian Edition, SI metric, McGraw-Hill Ryerson 1980 ISBN #0-07-014535-0

P Automotive Technology Nash, Fredrick C. Second Edition 1979, SI metric, McGraw-Hill Ryerson 1978 ISBN #0-07-092751-0

Diesel Fundamentals, Service and Repair Todbolt, W. Goodheart Wilcox

Fundamentals of Service "Electrical" John Deere Service Publication, John Deere Road, Moline, Illinois 61265

Fundamentals of Service "General" John Deere Service Publication, John Deere Road, Moline, Illinois 61265

Fundamentals of Service "Engines" John Deere Service Publication, John Deere Road, Moline, Illinois 61265

Fundamentals of Service "Hydraulics" John Deere Service Publication John Deere Road, Moline, Illinois 61265

Fundamentals of Service "Power" John Deere Service Publication, John Deere Road, Moline, Illinois 61265

Bendix Westinghouse Air Brake Equipment and Service Manual, Automotive Service School, John Bean Division, Lansing, Michigan

Barrett Brakes Training Manual Grey-Rock Division of Raybestos, Manhattan Inc., Manheim, PA

Grey Rock Brake Service Manual Henry Regnery Company, 114 West Illinois Street, Chicago, Illinois 60610

The Engine Cooling System National Carbon Company, Division of Union Carbide, Toronto, Ontario

Glenn's Emission - Control Systems Glenn, Harold T.

Automechanics Glenn Harold T. Copp Clark, Pitman 1976

Heavy Equipment Repair Nichols, Herbert L. North Castle Books, Greenwich, Connecticut

Engine Bearing Service Manual Seventh Edition Federal-Modul-Bower Bearing, Detroit 13, Michigan

P Prescribed Text

Why Recondition Rods? Sunnen Products Company, 7910 Manchester Avenue, St. Louis 17, Montana

Just What is a Pin Fit? Sunnen Products Company, 7910 Manchester Avenue, St. Louis 17, Montana

Small Engine Mechanics Crouse, W.H. and Anglin, D.L. Second Edition McGraw-Hill Ryerson 1980

How to Read, Use and Care for Micrometers and Vernier Gauges Starrett Company, Athol, Massachusetts

Service and Installation Manual Champion Spark Plug Company, Windsor, Ontario

Facts about Spark Plugs and Engines Canadian Spark Plug Company of Canada Ltd., Windsor, Ontario

Rotary Engine Yamamoto, Kenichi Toyo Kogyo Company 1971

Mechanics Fundamentals Stockel, Martin Goodheart-Willcox

Auto Service and Repair Stockel, Martin

Automotive Fuel, Lubricating and Cooling Systems Crouse, W.H. and Anglin, D.L. Sixth Edition McGraw-Hill Ryerson 1981

Automotive Tools, Fasteners and Measurements Crouse, W.H. and Anglin, D.L. McGraw-Hill Ryerson 1977

Automotive Electronics and Electrical Equipment Crouse, W.H. Ninth Edition McGraw-Hill Ryerson 1981

Pocket Automotive Dictionary Crouse, W.H. and Anglin, D.L. McGraw-Hill Ryerson 1976

Aids to Educators (Catalogue) General Motors Ltd., Oshawa, Ontario L1G 1K7

Ford Service Publications (Catalogue) P.O. Box 07150, Detroit, Michigan 48207

Instructional Materials Price List Mid-America Vocational Curriculum Consortium, 1515 West 6th Avenue, Stillwater, Oklahoma, 74074